

МЕСТО СТАРТА – ОКЕАН



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Annotation

A fascinating story about working on the Sea Launch space project.

The author is a direct participant in the described events.

For a wide range of readers. Of particular interest to scientists and specialists in aerospace engineering.

2000

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STARTING POINT - OCEAN

Instead of an Introduction

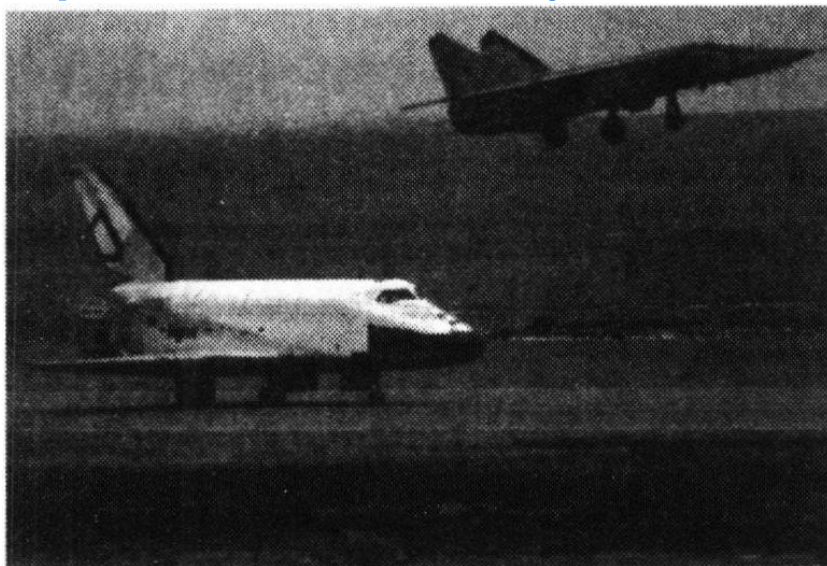
I took up my pen (or rather, my ballpoint pen) and realized how difficult it is to make myself gather my thoughts and put down everything that has accumulated over the past few years since the release of my last book, “The Path to “Energiya”.

Ten years have passed since the first launch of the “Energiya” launch vehicle, but even today, the events I witnessed and participated in are very vividly remembered.

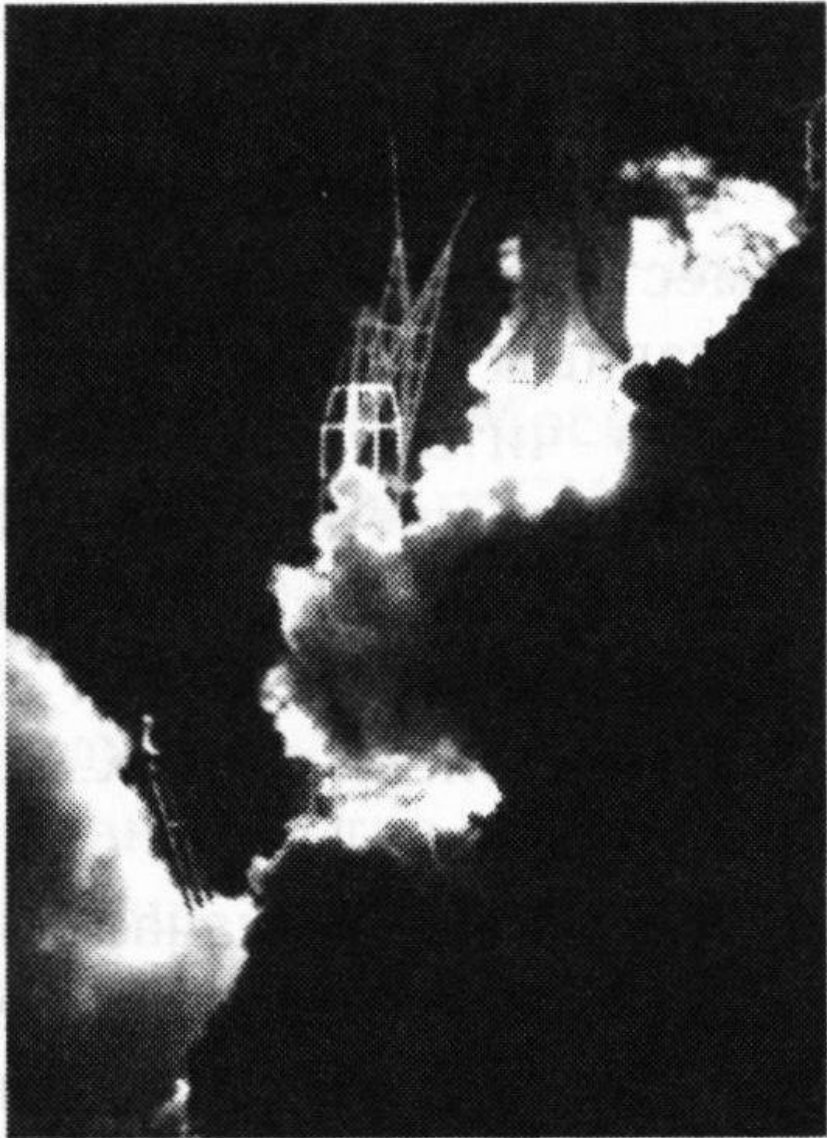
We have all aged these ten years, but that, it seems, doesn’t matter. In our hearts, we have remained just as young and passionate, and if someone were to say now, “This is necessary!”—we would again spend sleepless nights, argue until hoarse over our technical solutions, our rights to ideas. Again, we would offend our families with our inattention and rush time forward to see the fruits of our labor sooner. And how slowly it drags on in such moments!

THE DECLINE OF “ENERGIA— BURAN”

That historic launch of “Buran” had passed, when, in unmanned mode and facing a strong headwind, it made a perfect landing on November 15, 1988, at the Yubileyny airfield of the Baikonur Cosmodrome. And the ideas and enthusiasm of the developers turned towards a new, second flight.



Landing of OK “Buran”



Launch of LV “Energia” with OK “Buran”

It was necessary to test everything again on the stand regarding the new cyclogram of the launch vehicle’s operation. For these purposes, stand block 5S1 was brought to the universal stand-launch facility — for testing the central hydrogen-oxygen rocket block.

The same team gathered that had finished testing and prepared the first launch of the “Energia” rocket.

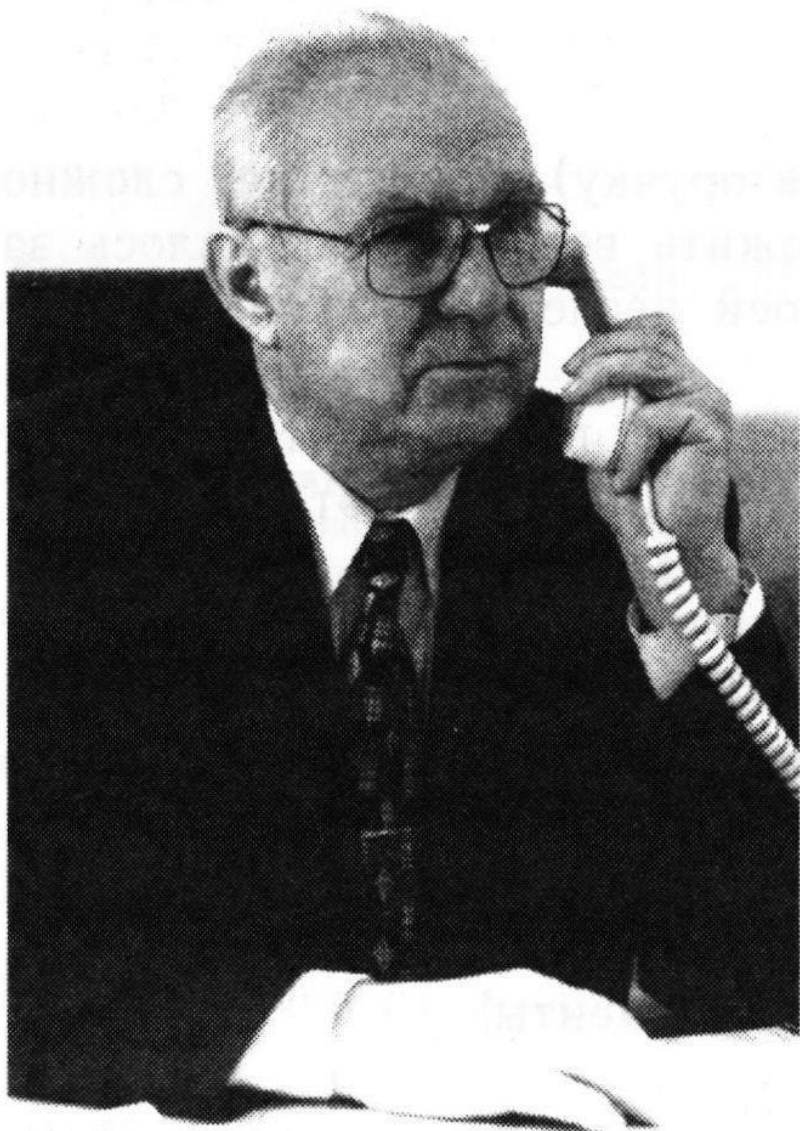
By this time, serious changes in leadership had occurred at our enterprise, NPO “Energia”.

Yuri Pavlovich Semenov, former first deputy of V. P. Glushko, was appointed General Designer.

Another former first deputy of V. P. Glushko, Boris Ivanovich Gubanov, quickly retired. He was also the chief designer of the ISS “Energia—Buran”.

Those who read my first book about “Energia” know about the relationship between the two Chief Designers.

Apparently, fate does not tolerate strong personalities together. In history, an example of this is how S. P. Korolev and M. K. Yangel were separated into different design bureaus. The situations were similar. The rocket direction of the NPO could not benefit from this; rather, on the contrary, all sorts of insinuations began from the new General’s associates, and, first of all, they went through the new structure of the enterprise, and our former Chief (B. I. Gubanov) was left without a team.



Yuri Pavlovich Semenov

The complexes were regrouped, the designers were separated, deprived of the opportunity for operational work at the technical complex, and the leadership's thinking began to form. And then there was an accident at the test site: due to carelessness, B. I. Gubanov fell, broke his femoral neck, and ended up in the hospital.

"Do you understand what happened?" Alexander Alexandrovich Makarov, director of NIIKhIMMash, asked me. "Have you all fully realized what this could mean for Boris?"

"What do you mean?" I replied to Alexander Alexandrovich with a question.

“What happened to us with Karneev. We didn’t take him to Moscow in time, and then it was too late.”

“What do you suggest?”

“Call the General and take all measures to transport Boris to Moscow.”

The General already knew everything thoroughly; he visited his former friend in the hospital. They whispered about something for a long time.

After that, he told me:

“Vyacheslav, I gave Martynovsky the command to organize Boris’s departure. You need to accompany him. Report back. Organize everything here so he flies to Moscow.”

At that time, our Il-76 was on lease. Its flights were outside the Union. But connections did their job, and they got a plane from another squadron.

With a roar, the ambulance rushed through Moscow to the airfield. Reporters from various media outlets also rushed after it. All this would be shown on television. But the reporters were not allowed beyond the gates of Vnukovo-3 airfield.

We are waiting for the plane with the ambulance at Krainiy airfield in Baikonur.

It was autumn. Daylight was ending very quickly.

We meet the plane. How many times do you watch the takeoffs and landings of these winged machines and can’t tear yourself away. And you seem to understand theoretically why they fly, and you’ve studied the aerodynamics of flight, but when you see a heap of metal accelerate, lift off the ground, and soar into the air, it all seems like magic.

And a night landing, when a black bird descends, fully illuminated, onto a runway marked with multicolored lights, the spectacle is simply mesmerizing.

“Are you Filin?”

“I am.”

“Where are we going? We have very little time,” said the doctor who arrived from Moscow.

“To the hospital. They are waiting for us there.”

The drive to the hospital in Leninsk took about twenty minutes.

A special gurney had already been brought up to the third floor.

“Well, shall we fly?”

“Yes, everything is ready. The plane is on the runway.”

At that moment, a nurse approached and quickly gave him an injection.

“What are you doing? I didn’t ask for this,” were his last words. He leaned back and fell asleep.

The doctor from Moscow approved. After all, the pain was very strong and would become simply unbearable with shaking.

“You did the right thing.”

Very skillfully, the paramedics transferred him to the wheelchair, adjusted something in the mattress, and inflated the mattress.

“Now we are calm. There will be no incidents until Moscow. The mattress has taken the shape of his body.”

The procession slowly moved towards the exit. The gurney into the car and back to the airfield.

Everything happened so quickly that Firsov L.G. and I didn’t even notice how we found ourselves in the plane with the ambulance, and now it was already speeding across the airfield. We took off. An hour into the flight, sitting on the side benches, we began to come to our senses. It turned out that all the food taken for the flight had been left at the hospital. It was good that the guys had something to chew on.

A paramedic approached.

“The patient is asking for Filin. Who is that?”

“That’s me,” I said and entered the ambulance.

“Is that you, Slava?”

“Yes.”

“Where am I?”

“In the plane, more precisely, in the car and in the plane.”

“Give me your hand. I’m terrified. Sit next to me.”

I sat down next to the stretcher on the folding chair. I felt uneasy.

The car’s vibrations were superimposed on the plane’s usual vibrations, creating a kind of “mess.” My vestibular system couldn’t handle it. An internal fear appeared. I imagined that the Chief had another suspended support in the form of the transported wheelchair. It probably added its own additional tone. Hence, his sensations were stronger than mine. Now I understood why he felt terrified when he woke up from sleep.

Slowly, we began to get used to this state.

“There, in the bag, the girls from the canteen prepared a ration for me for the journey.”

“Which one?”

“I don’t remember.”

“There is no bag. We forgot it.”

“That’s a shame.”

“I’ll figure something out now.”

I went into the cargo compartment. The guys were dozing.

“Who has something to eat?”

“Here’s some bread, sausage. Make him a sandwich,” replied L. G. Firsov.

I took the sandwich and went back into the car.

“And what to drink it with? Is there nothing?”

At first, I didn’t understand what he was talking about. Then it dawned on me.

“Are you allowed?”

“My stomach doesn’t hurt.”

Back to the compartment.

“Len, what can you find?”

He found a little.

“That’s better. Otherwise, nothing goes down,” the Chief grumbled contentedly.

The unusual vibrations no longer bothered us, and we didn’t notice when we touched down on the Vnukovo runway. Service vehicles met us. And we rushed after the ambulance to the hospital. The stage was completed. I arrived home around two in the morning.

Treating a fracture is a long process and requires prolonged bed rest. This is approximately three to four months.

With this episode, I only wanted to highlight the cohesion and support of the developers of rocket and space technology and the capabilities they possessed.

So we were left without our leader during this period, which was not the best for rocket scientists.

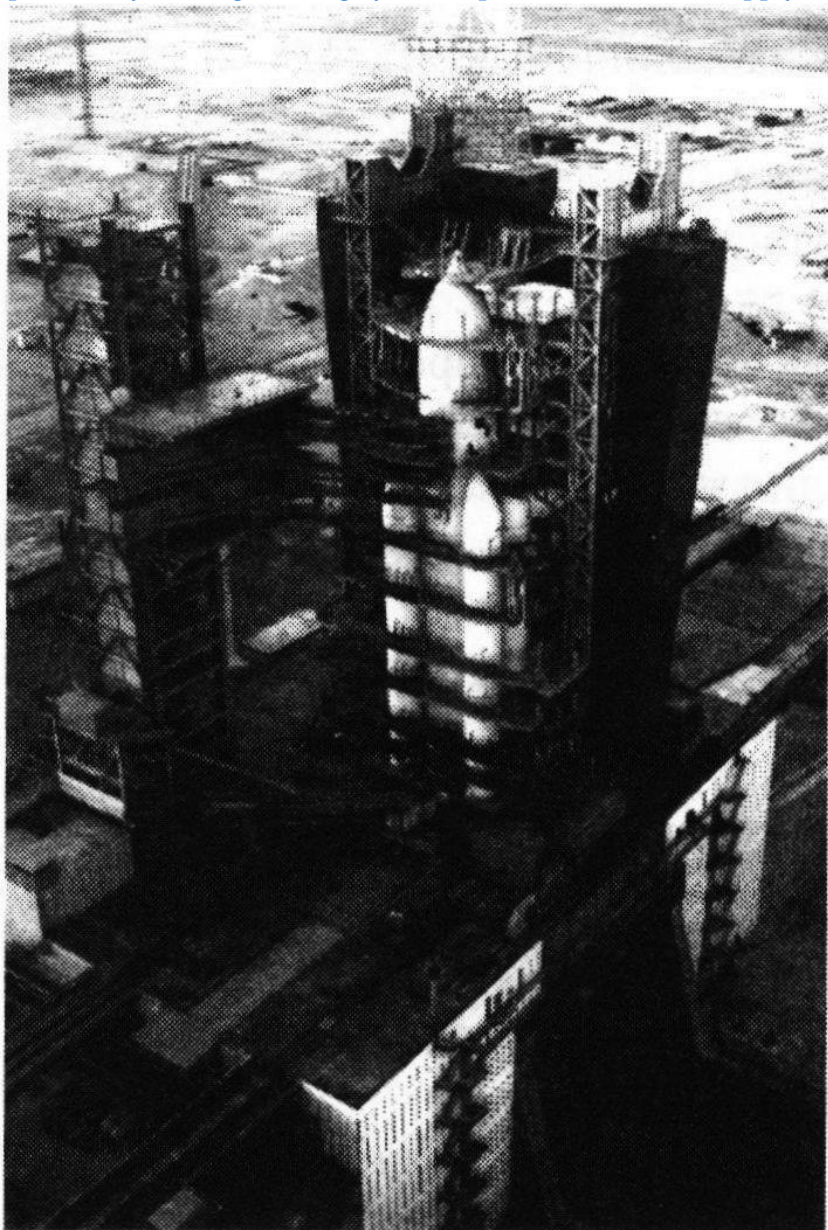
But let’s return to the product. This behemoth rocket (stand block 5S1) stands on the UKSS (stand), completely enveloped by service platforms, as if asking: “Have you checked everything? I am ready, are you?”

Two days before the tests, I flew to the cosmodrome. The General appointed his deputy, Vladimir Mikhailovich Karashtin, as the technical director of the tests.

Dozens of supporting systems were again put into operation: gas supply, power engineering, thermostatic control, fire and explosion safety systems, and many others. The bunker was full again. Specialists from NIIKhIMMash and military specialists worked here. The work was supervised by

A. A. Makarov, now the director of NIIKhIMMash, and his first assistant

A. M. Svinarev. Next to them at their workplaces were technical consultants—system developers, and here too were representatives of the military unit and its command. They bore all responsibility for engineering systems, power, and water supply.



Unified stand-launch complex

We took our workplaces. By tradition, I sat down with the hydrogen engine developers. The agonizing hours of fueling the rocket began. After all, it was necessary to pour about 600 tons of oxygen and about 100 tons of liquid hydrogen. Purges, chilling,

data collection on temperatures, gas analyzer operation — all data converged at the “First.”

The fueling of the central block had been well practiced on a special mockup, and no incidents had occurred during the two regular launches. A meeting of the state commission was held. Artur Vladimirovich Usenkov, Deputy Minister of General Machine Building, urged everyone to be cautious and gave the go-ahead for the work.

Before the bunker closed, the General arrived with his first deputy, Nikolai Ivanovich Zelenshchikov.

“How are things?”

“So far so good, ‘Launch’ soon.”

They sat closer to the test leaders’ table.

Oh, those agonizing minutes before launch!

After consulting, the “First” gives the command:

“Press the ‘Launch’ button.”

This means that exactly 600 seconds remain until the engines ignite. Automation has begun its work. Now it queries the systems about their status and opens the way for further events. If something is wrong, the process immediately stops.

Seconds flew by, and with each moment, the tension increased. What if? After all, 450 tons of TNT — the equivalent of the energetic capabilities of the fueled propellant — stood on the stand, awaiting its fate. That’s why all systems are checked a thousand times, commands are checked, and hydrogen tightness is especially checked: after all, a 4% mixture is an explosive gas, and then...?!

Seconds tick by. Silence in the bunker. Only the fans in the consoles whir.

And suddenly! Like a bolt from the blue, on the shared screen — APP (emergency launch abort). Everyone was stunned.

I immediately rush into the control room:

“What happened?”

“We’ll understand in a moment,” replied V. Ya. Strashko and A. I. Gasparyan. The ground computer was already printing its tape with parameters.

A quick analysis showed: three parameters were out of order. They prohibited further work.

“What happened?”

“An APP occurred due to three parameters.”

“What parameters?”

“We’re figuring it out.”

“Make a decision,” the General somehow addressed me. I didn’t argue, although in such a situation, the technical director of the

tests makes the decision.

He entered the control room. They began to sort out the parameters. Although they were introduced into the emergency process abort scheme, they did not affect the engines' performance.

They began to think about how to mark them (exclude them from the process).

V. Ya. Strashko quickly "crawled" through the diagrams.

The room became crowded. Everyone was eager to move forward.

"Make a decision," the General addressed me again.

"We have 40 minutes. During this time, the product can remain in a safe state."

"I'm going to my workplace, I need to be ready for anything," Karashtin said and ran into the control room.

I approached V. Ya. Strashko.

"Well?"

"Two parameters can be marked manually, but we need to think about the third."

"We have half an hour."

"I understand."

The General approached. I reported the situation.

"What is proposed?"

"There is time."

"Report in 10 minutes."

And again:

"Make a decision."

It was not possible to mark the third parameter.

There was only one solution — drain the machine. As sad as it was, the tests failed. Who knew that this was the last attempt at fire work with the most powerful rocket in the world.

The fuel components were drained. Everyone dispersed to their hotels. For another day, the product stood alone, evaporating, on the launch pad. Then it was removed, placed on the erector, and locomotives carefully delivered it to the assembly and test facility (MIK).

Everyone understood well that there had been a colossal disconnect between launch vehicles and the development of spacecraft. We were left without a payload. And why launch such a behemoth with an orbital vehicle to put satellites of five, ten, or even twenty tons into orbit? There are also disposable launch vehicles "Soyuz" and "Proton" for this. Their launches are significantly cheaper. And the global political situation had become completely different.

The era of glasnost arrived. Perestroika swept the country.

Even a special program, “Perestroika Spotlight,” was broadcast on television. Very quickly, we became friends with America. The SDI (Strategic Defense Initiative) program was curtailed.

Here I want to remind the reader once again that the entire “Energia-Buran” program was an order from the Ministry of Defense. After all, during the “cold” war, the strategy of attack and defense moved into space. After Reykjavik, this became unnecessary. So we were left without a customer for this system. For national economic needs, the system was too expensive.

Two fully assembled “Burans” and two “Energia” launch vehicles remained at Baikonur.

General Designer Yu. P. Semenov frantically searched for a payload not for orbital vehicles, but for “Energia.” He perfectly understood that “Proton” and “Soyuz” rockets could deliver payloads into orbit, but using the existing power of “Energia” (100 tons of payload) was a very tempting task. Only our country in the world possessed such a rocket.

Various projects for the use of “Energia” began to emerge. These included projects for the space disposal of particularly dangerous radioactive waste, for the restoration of the ozone layer, for illuminating polar cities, and others. One of the projects seemed more or less realistic to us. This was the project to create a universal space platform (UKP). One of the deputy general designers of NPO “Energia,” V. G. Kravets, was involved in this platform.

The meaning of this project was that a spacecraft weighing approximately 18 tons would be launched into geostationary orbit, which would provide communication and direct television to all objects, both mobile and stationary, over a vast territory of Russia. Money was needed for this project.

This happened at a time when the Union ministries collapsed, and the space agency in Russia had not yet been created. When all industries: aviation, rocket, and machine-building — were united into one Ministry of Industry of Russia, which was unable to monitor, plan, and control the work of enterprises. Privatization began. Enterprises were left to themselves.

It’s good that we kept our aircraft fleet. The General gathers the main ideologists of this project: Zelenshchikov N. I., Ryumin V. V., Kravets V. G., Tsybin S. P., invites the Deputy Minister of Communications of Russia and the Chairman of the Supreme Soviet Committee L. V. Sharin, responsible for industry, and sets off by our plane to the Far Eastern regions to seek support for the project and funds.

First stop — Krasnoyarsk. The stop in Krasnoyarsk was caused

by two reasons. Firstly, it was the maximum flight for our “Tushka” (Tu-134), and secondly, “Krasnashzavod” manufactured rocket modules for upper stages for us. These modules were then assembled at our factory and given to the “Proton” rocket as space upper stages. For the “Energia” launch vehicle, one block was clearly not enough energetically. Many options were discussed when choosing the upper stage: a hydrogen upper stage and a block with enlarged fuel tanks were proposed. But the General put an end to this question:

“We will make a tandem — we will put two upper stages. After all, creating a new block will take at least five to seven years, and we don’t have them. In this case, we rely on a well-established manufacturing technology and the achieved reliability of an already existing block; we just need to check the production capabilities. That’s why we stopped in Krasnoyarsk, to make sure on the spot that “Krasnashzavod” would not let us down.”

While the plane was being refueled, we went to “Krasnashzavod.”

The factory director V. K. Gupalov received us warmly. He showed an originally executed factory plan, explained how production was organized, and assured us that there would be no problems with the manufacture of modular parts.

We exchanged souvenirs, had dinner, and then went to the airfield. Only V. K. Parmenov, at that time the deputy director of the experimental machine-building plant for production, managed to pop into the workshop where the rocket modules were made. He was incidentally solving his production issues. The connection between the two factories was very close. A large nomenclature of mutual deliveries required clear time schedules. V. K. Parmenov managed to coordinate them while we were having dinner.

A night flight — and we are in Blagoveshchensk. A one-day stop. Representatives of neighboring regions gathered. We told them about the system. But we did not meet with enthusiasm: no one had money for it.

In the afternoon, we became guests of the head of the border detachment. He took us to the Amur River. I never thought the Amur had such a strong current. On the opposite bank was China. We heard many interesting things about the interaction between our and Chinese border guards. I also remembered the ensign who quickly organized dinner. Excellent fish soup and shish kebab. We visited the banya. Everything gave the impression of a stable, well-organized border guard economy. The commander himself was especially memorable. Calm, confident, tall, and stately military man. They showed us the city. It struck us with the cleanliness of its

streets and the neat facades of its houses.



Viktor Kirillovich Gupalov

Again the plane. And here — Vladivostok. We landed at an airfield where both civilian and military aircraft stood. Bus, hotel. A sharp contrast with Blagoveshchensk. Gloomy, dirty streets. In the Golden Horn Bay, I hoped to see clear blue water. But alas! The entire bay was covered with a dark film of fuel. Whether it was kerosene or oil — everything shimmered in the rays of the setting

sun.

In the morning, another meeting. We talked about the platform, its capabilities to provide the Far Eastern region with communication and television. Regional representatives listened. But their faces showed that they had gathered only out of respect for Sharin L. V., the former first secretary of the regional communist party. Valery Viktorovich Ryumin (cosmonaut-pilot), at that time a deputy of the Supreme Soviet, told Sharin L. V. what space could offer the Far East. Sharin L. V. embraced the idea. After all, this region was native to him. He had been the first secretary here for many years and enjoyed well-deserved authority. He organized this trip for us.

The meeting was not supposed to end with a specific document; it was, as they say, introductory, setting the stage. The representatives, leaving, promised to report to the leadership of their regions. With that, the business part of our trip ended.

Again, the border guards took us under their wing and took us to relax on Russky Island. Now we saw the ocean. The water was crystal clear, everything on the bottom was visible as if in the palm of your hand. Full of large shells. The water was 23 degrees, sun. Some started fishing, but most rushed to swim. Only later, in the evening, did we discover that we were quite sunburned.

In the morning, the weather unexpectedly began to worsen. We wanted to watch the parade of ships dedicated to Navy Day. But experienced people warned that if it rained, we could get stuck for a week.

“What are your suggestions?” the General asked the Tu-134 commander.

“Whatever you say.”

“And you?”

“We could get stuck. They might not give us clearance to depart.”

“How long could we be delayed?,”

“They say for a week.”

“That won’t do. Let’s fly. Did you submit the request?”

“Yes, it’s been arranged.”

As much as we regretted it, we didn’t get to see the parade. We quickly gathered and flew to Irkutsk. Then — Omsk and Moscow.

The flight was remembered for a long time, and it lasted 18 hours. In the second cabin of the plane, a gambling house unfolded. As soon as we took off, we started a game of cards. We played with excitement, with dark suits, bombs. We played non-stop for four hours (the time from takeoff to landing for refueling).

Zelenshchikov N. I., Ivanov M. N., Gorodnichy Yu. P. and I argued

until we were hoarse. We understood that cards were a foolish pastime, but getting carried away, we forgot about everything. We smoked so much that you could hang an axe in the cabin. Yu. P. Gorodnichy was especially notable. A cigarette literally never left his smiling mouth. In the end, of course, there were no losers. We just tore up the scorecards. But that was at the end, and during the game, we fought as if we were losing a cow. We returned to Moscow late in the evening, tired and stunned, either from the flight or from the smoking. This was the last trip across the country in defense of “Energia.” The regions had no money, and the development itself “limped along.”

The topic “Universal Space Platform” was abandoned, and following that, the last opportunity to provide payload for the “Energia” launch vehicle was also lost. Everyone understood that “Energia” was ahead of its time, and that it would probably only be in demand in the 21st century. Finding a 100-ton payload was beyond the capabilities of institutes and industry.

The idea arose to create a rocket that would launch approximately 30 tons into orbit. To use the side blocks of “Energia,” but not four, but two, and to make a new central block with one hydrogen engine. The remaining technical facilities from the “Energia” launch vehicle — all the technological equipment, the erector, the launch position, the engineering systems — could be used directly, that is, without modifications. The project was born quite quickly. The new rocket was named “Neuron,” as if in opposition to the “Proton” launch vehicle.

Opening a new topic is quite difficult, so the General resorted to a trick. Within the framework of the “Energia—Buran” topic, he began to create the “Energia-M” launch vehicle; in terms of its characteristics, it was the same rocket (“Neuron”), but its name did not scare anyone.

Immediately, together with the branch of the “Progress” plant, they began creating a demonstration model at Baikonur.

They developed the necessary schedules for issuing technical documentation and experimental development. Work seemed to boil on the remaining financial resources from the ISS “Buran.” But events occurred when the mighty USSR became the CIS. The cooperation of developers was scattered across various countries. All sorts of associations and companies came into vogue.

Having arrived at the test site for another manned launch, our General, Yu. P. Semenov, convened a meeting in his office at site 254.

All our main associates gathered. General S. N. Konyukhov from KB “Yuzhnoye” arrived, B. I. Katorgin from NPO

“Energomash,” General V. S. Rachuk from KB KhA, Director of NIIKhIMMash A. A. Makarov, and V. A. Brynkin from the administration of Leninsk.

“Today the situation is such that we cannot do anything without each other,” Yu. P. Semenov began the meeting. “We have been torn apart. We must find a form of association that would help create a new product. I mean, first of all, the creation of the “Energia-M” launch vehicle, and this will also allow us to support the production of the “Zenit” launch vehicle.”

A lively conversation began.

“We are for it!” said S. N. Konyukhov. “Today, if Russia does not support the production of “Zenits,” we will lose the best, most modern rocket. And behind it are Russian enterprises.”

“We are also for it!” B. I. Katorgin continued the conversation, as it were. “We are ready for cooperation. We just shouldn’t stand still; we need to move forward.”

“The administration of Leninsk is also for it. Just one request — to register the enterprise in Leninsk,” V. A. Brynkin expressed his wish.

The ground crew, represented by General I. V. Barmin of KBOM, also supported the proposal.

Back then, with our socialist mindset, we didn’t understand much about these joint ventures. The fashion for them swept across the country. Thousands were created. Many were proud to become general directors of enterprises, even if an enterprise had only three people.

“Let’s consider our meeting the first meeting of the founders,” Yu. P. Semenov proposed, “let’s agree on entrance fees and elect a chairman of the board of directors.”

“There are no questions here. I propose, and I hope everyone will support me, to elect Yu. P. Semenov as chairman,” S. N. Konyukhov authoritatively proposed.

Everyone unanimously supported it.

“We need to draw up protocol number one and elect an executive director.”

My lead designer, L. G. Firsov, was elected Executive Director, and he was entrusted with the further registration of the new enterprise. Further steps were discussed. At that time, the status of the Baikonur Cosmodrome had just been defined. Everything became Kazakh: the facilities, the buildings, the rockets, and the cars. But all this was legally. In fact, the testers and military operated all of it.

“It would be good if our initiative was supported by the presidents. Whether we want it or not, neither Russia nor Ukraine

can do without Baikonur. I will take on my president,” said

S. N. Konyukhov.

“And I will arrange a meeting with N. A. Nazarbayev,” Yu. P. Semenov added, “Vitaly Alekseevich, I ask you to organize our meeting in Alma-Ata, I mean the plane, the hotel.”

“No problem. Everything will be top-notch.”

During those turbulent times, I often had to fly to the capital of Kazakhstan as part of state delegations. Agreements were being prepared on the lease of the cosmodrome and on the interaction of space agencies. Primarily, employees of the Russian Space Agency (RKA), led by Yu. N. Koptev, handled this. We were present as technical consultants. But all negotiations were difficult. For us, Russians, it was offensive that we had lost everything at Baikonur, and the Kazakhs had not yet fully understood what they had gained. They did not understand that all these material assets required regular investment of huge sums of money to maintain the complex in working order. And there was no money. As the saying goes, they wanted it, but it was painful.

The position was worked out long and tediously. In the end, Baikonur was leased to us.

Yu. P. Semenov called N. A. Nazarbayev. He gave his consent to the meeting. The President understood well the political capital that Baikonur and space provided. He himself, back in Soviet times, had visited the cosmodrome many times. He understood well that all advanced science and technology, one way or another, passed through space. Nursultan Abishevich also knew our General well. He accompanied him on the flight of the first cosmonaut of Kazakhstan. And warm receptions bring people together like nothing else.

In mid-December, we were scheduled to fly from Krainiy airfield to Alma-Ata.

When you remember the test site in Kazakhstan, endless steppes and the sun rise before your eyes. In winter, frosts reach 30 degrees Celsius, and in summer, the heat reaches 44 degrees Celsius.

And before the flight, during the night, the sky was covered with ominous clouds, and such snow fell that we rarely saw even in Moscow. It was good that the plane arrived early. We thought the snow would stop by morning. But it only weakened a little, and then the wind picked up, driving these millions of snowflakes, and they ran across the steppe, filling all the pits and potholes as they went. I immediately remembered A. S. Pushkin’s “The Captain’s Daughter.” This ground blizzard brought us no joy. The General was nervous; we could be late for the president. And that was not good.

The cosmodrome commander, as they say, personally took control of the airfield's preparation.

We arrived at the airport. Machines were clearing the runway. Time was pressing. Clearing the runway to its full width was not possible. They only cleared it to the width of the rear landing gear wheels. But the ground blizzard, transverse to the runway, left white waves.



Vladimir Ilyich Pyatkin

The commander of the Tu-134, Vladimir Ilyich Pyatkin, was tense.

Four of us boarded the plane: Semenov Yu. P., Martynovsky A. L., Danilov Yu. M., and I.

Slowly, we began to taxi to the start of the runway. From the engine's operation, a solid white wall formed behind the plane. We tested the engines and began our takeoff run in this snowy corridor. Faster, faster, even faster, the airfield buildings flashed past the portholes.

A sharp jolt! Everything inside went cold.

"We must have stumbled over a snowdrift," I thought, and at that very moment, the plane sharply surged upward. Phew! We took off.

About fifteen minutes later, I went into the cockpit. V. I. Pyatkin was sitting in the first pilot's seat, completely drenched in sweat.

"Well, how was it?"

"It's fine."

"Did we stumble over a snowdrift?"

"Yes! They couldn't clear it wider, idiots!"

"Such a takeoff won't reduce gray hairs."

"That's for sure."

Alma-Ata welcomed us. The Minister of Science met us.

"First, let's go to my place. Let's look at the documents," he said.

We drove to the ministry.

"Well, actually, there's only one document. It's just a letter from Nazarbayev N. A. to Yeltsin B. N.," said Semenov Yu. P.

"That's good that it's one."

He carefully read the draft letter.

"Let's strengthen a few phrases about cooperation."

"As you wish.,,"

"I think this will be more convincing."

The minister took a pen and began to correct the letter.

"We have an hour. We'll have time to retype it.,," the minister assured us.

Indeed, with computers at hand, it's not particularly difficult.

"It's time for us to go. Let's decide who will go."

"I think myself and Filin," said the General.

"Very good. I don't think everyone needs to go."

We got into a "Volga" and drove to the Government House.

I was often surprised by the atmosphere in that house.

Accustomed to the bustling life in the design bureau, here I was amazed by the silence, the calmness; no one was rushing anywhere.

We went to the right wing. Apparently, all posts had been warned. The guys just passed us on to the next posts using their mobile phones.

Suddenly we had to stop. The guard was changing at the state

flag.

We entered the reception area. Again, silence. No ringing telephones, no clattering typewriters.

“One moment. I’ll report,” said the assistant and entered the office.

“The President invites you.”

We entered the office. Nursultan Abishevich rose from his desk, shook hands with each of us, and invited us to the conference table.

“We have come to you with a request,” Yu. P. Semenov began. “So much has been created on the ‘Energia-Buran’ theme, and to lose it would be a crime. We have long thought about how to use it. Finding a payload for an orbital vehicle is practically impossible, and for ‘Energia’ — it’s also a problem. So we propose a new launch vehicle ‘Energia-M’ — a small ‘Energia,’ with a payload capacity of approximately 30-35 tons. There is a large stock of side blocks at Baikonur. They can be used. The erector and launch pad can be used practically without modifications.”

“What does such a launch vehicle offer?” Yu. P. Semenov asked himself, as it were, and answered. “Today, everyone is striving for geostationary orbit: this includes television, communication, and navigation. This includes providing all of Kazakhstan with all of this. Today we have only one launch vehicle — ‘Proton,’ which, with our upper stage, launches satellites into GSO. But there are two circumstances that we cannot ignore: that the launch vehicle is 25 years old in design and, most importantly, it operates on toxic fuel components.”

“That’s a very strong argument. I have difficulty restraining the ‘greens’ — environmentalists,” N. A. Nazarbayev immediately joined the conversation, “because in the fall areas, it’s a real disaster. These are huge territories contaminated with this filth. This leads to losses in both livestock breeding and agriculture. But the most terrible thing is that herds of saiga, these animals listed in the Red Book, are dying. I am for it. Your proposals need to be implemented as quickly as possible.”

“We gathered at Baikonur and decided to create an interstate company for the creation of such a launch vehicle, which, as we propose, will also include the administration of Leninsk.”

“I don’t object.”

“But we need your support and that of Boris Nikolaevich Yeltsin.,,

“I repeat, I am for it.”

“Your letter to Boris Nikolaevich has been prepared here,” the minister interjected, “please sign it. It is dedicated to this issue. I

have carefully read and endorsed it.”

Nursultan Abishevich began to read. The second copy of the letter lay before me. I tracked every line and suddenly — oh horror! On the sheet where N. A. Nazarbayev was supposed to sign, I saw an error. Everything inside me went cold. Pushing the General, I pointed out the error with my eyes, and he reacted instantly.

“Nursultan Abishevich, we wanted to agree with you in principle on the text. There is a typo in the text.”

Nazarbayev N. A. did not react at all. Finishing reading, he raised his head.

“I agree with the text completely and I will sign it, please correct the inaccuracy. I just fear that Boris Nikolaevich will not read it. Oh well. And what about the launch of the second Kazakh cosmonaut?”

“Consider that question resolved,” the General assured.

The conversation concluded.

“If you have any questions, Yura, call me,” he said goodbye.

We left. It seemed that we had fulfilled our mission 100 percent.

“I will take the letter from you. It needs to be registered and sent by government mail,” the minister said.

We picked up our companions and went to lunch at the government dacha outside the city.

Then the airfield. By the commander’s expression, we understood that everything was in order — Krainiy was accepting.

“Well, how are you?” Arkady Leonidovich Martynovsky asked the ship’s commander.

“Everything is in order, formalities are completed. The runway at Krainiy is clear, we can fly,” V. I. Pyatkin replied.

“Then let’s go.”

Our letter was the first attempt in the fight for “Energia-M.” We never found out if Boris Nikolaevich read this letter. But we knew for sure that a similar letter was sent by the President of Ukraine, L. D. Kuchma.

We understood very well that letters alone would not help the cause. Public opinion needed to be prepared. We decided to appeal to the Presidents, on behalf of the chief designers and directors of institutes in Russia, Ukraine, Belarus, and Kazakhstan, to help in the creation of a new rocket. Everyone was in favor!

I pitched the idea to the General Director—to create a demonstration model of the rocket. The General Director seized the idea and immediately ran with it. We went to see Grigory Yakovlevich Sonis, the director of the Progress plant’s branch at Baikonur. After the work on “Energia” stopped, he was left without

a project.

—I'll make such a model in about three months.

—Why so long?

—First, I need at least the simplest documentation.

—I will give the necessary instructions to Petrenko S. A.,—the General Director immediately decided.

—And second, it's simply technological time. We need to weld the shells, manufacture the central block, and assemble the rocket. That takes time.

—Perhaps we could involve the main production? I'll ask A. A. Chizhov (director of the Progress plant in Samara).

—No, that's not necessary. I'll do everything myself. Otherwise, we'll spend even more time. Send designers from the Volga branch here.

—Alright.

That's what we decided.

We flew to Moscow. We made a stop in Samara. A. A. Chizhov and S. A. Petrenko met us. We went to the director's office.

The General Director began to talk about the rocket.

—That's wonderful. My workshops are idle, my test stands, both static and cryogenic, are idle. This is a very good solution.

—So, it's agreed, Stanislav,—Yu. P. Semenov addressed S. A. Petrenko,—give me a schedule for issuing working documentation so that all documentation is at the plant by the end of next year.

—I don't have the initial data yet.

—Then mark in the schedule when the initial data is needed. And you make sure everything is issued on time and appoint a lead.

—Alright. S. Yu. Prokofiev will be the lead. We will help create the schedule. A general creation schedule is also needed.

—Yes, it is needed. That's your concern. But I warn you, I will personally oversee the progress of the work. You've forgotten how to work. I'm keeping you, rocket engineers, afloat through the manned program. It's time for you to think about that! And earn your own bread.

It was offensive to hear such words from the General Director. Where did he get such information? I knew for sure that the funds allocated by inertia for the "Energia-Buran" project, or rather, for its closure, were still quite sufficient for us and the Volga branch.

Work on the documents and the model began in earnest. Everyone was eager for real work.

Our main co-contractors, with whom we created "Energia," literally overwhelmed us with questions about when they would receive initial data from us, but most importantly, a contract for the work.

Calls and letters from engine builders in Khimki and Voronezh, control system developers from Kharkiv, telemetry specialists from Izhevsk, drive developers from Leningrad, and our other co-contractors literally poured in every day.

By the end of 1990, the model was ready.

I arrived at the test site with A. A. Makarov, the same one with whom we launched the first “Energia” rocket from his launch pad. He became the director of his institute after Yu. A. Karneev.

A SMALL DIGRESSION

People's characters are such a diverse state that sometimes one is simply amazed at their multitude. Sometimes a certain type of character can be identified. Astrologers divide them by Zodiac signs. This is very fashionable now. Medicines have become scarce, and their prices are sometimes unaffordable for ordinary mortals. So many have turned to the study of celestial bodies.

But there is a type of person about whom people say: "This is a master!" This person will foresee everything, think through everything, whether it's a simple event that is about to happen, or a significant matter. These people have a tough, demanding character, both towards themselves and towards others. They are patriotic, starting with their family, their home, their enterprise, their city, region, country. Everything must be in its place for them. Such people think through everything their children need, everything their enterprise needs, down to the smallest detail. To achieve these noble goals, they sometimes resort to almost childish tricks. But with their assertiveness and charm, and sometimes small favors, they achieve their goals.

Such people practically never make mistakes. They arrange the slightest everyday operation in such a way that even weather cataclysms cannot stop the upcoming event.

They build the logic of their behavior on simple facts, understanding their partner's psychology well. They do not shy away from asking their friends for small favors, but this is, as a rule, for the common good. They cannot ask for something for themselves, nor can they protect themselves from rude people. Everything is hidden inside. Over time, this results in complications due to nervous breakdown. But that's later. The requests of friends and colleagues are law for them. They are not guided by the proverb, "You told me what I need to do, and I will explain to you that I cannot do it." No, such people quickly weigh their capabilities and think about how to help. Not to refuse, but to help. And if they cannot answer positively immediately, they take time.

"Well, alright," they usually say, understanding that the matter will be done, and the request fulfilled.

Such a person is the director of NIIKHIMMASH, Alexander Alexandrovich Makarov.



Alexander Alexandrovich Makarov

On his shoulders rested not only an enterprise with a multi-thousand strong workforce, but also an entire settlement, Novostroika, near Sergiev Posad. I often had occasion to visit his enterprise. And when we walked through the stands or production halls, nothing escaped his gaze. Along the way, he made individual remarks to his colleagues, and these were not nitpicking, but precisely remarks. He automatically transferred his managerial spirit to his colleagues, who did not take offense at his reprimands, but accepted his words as useful advice. Sometimes he was sharp and, with an inflated strictness, liked to urge and scold. But it must be acknowledged that his authority was indisputable.

In difficult times, when there was practically no funding, he managed to quietly build housing. He even converted a former

soldiers' barracks into housing for employees with his own efforts.

In the settlement, he built a recreation area with a small artificial lake, which was called "Makarkin Pond."

But his main concern, of course, was finding work. He looked for it everywhere: in his district and at the Baikonur Cosmodrome. At a time when the Ministry of Defense was unable to maintain the elements and infrastructure facilities of the cosmodrome, he, having highly qualified personnel, boldly took on maintenance work. His energy was enviable, but only with "white" envy.

He especially valued friendship. His friends never had even the slightest doubt that in a difficult moment he would be there, would not renounce, and whatever could be done, whatever was within his power or even beyond his power, he would do.

I am confident that in all his deeds he finds his happiness.

LAST ATTEMPTS

The mock-up of the Energia-M rocket was placed on the erector. We are accustomed to symmetry. It seems to us that nature itself instills this symmetry in us from childhood in everything: in a maple leaf, in the human form, and in the form of an animal. But look closely and you will see that against the background of apparent symmetry, there is so much asymmetry. This applies to literally everything. So we saw this, seemingly symmetrical body of the rocket, lying on its side. The erector seemed to be missing additional blocks, pulling our creation to the stand-start.

We understood well that this was a mock-up. The path to the rocket was oh so long! It seemed that everything was there: engines, side blocks, and the launch-docking block. Only two tanks needed to be manufactured. One — oxygen, the other — hydrogen, and the nose fairing. And there was plenty of space under the nose fairing to accommodate spacecraft. Apparatuses with a total mass of up to 34 tons could fit. This is one and a half times more than the Proton rocket can launch. But Proton had already come a long way in its development and had become very reliable. And we had to go through this huge journey.

Sometimes it seems, what's so special about making a new rocket? As stated above, everything is there! But the laws of rocket science, developed over years, for which people's lives have been paid, said that before flight, one had to "eat" more than one pood of salt.

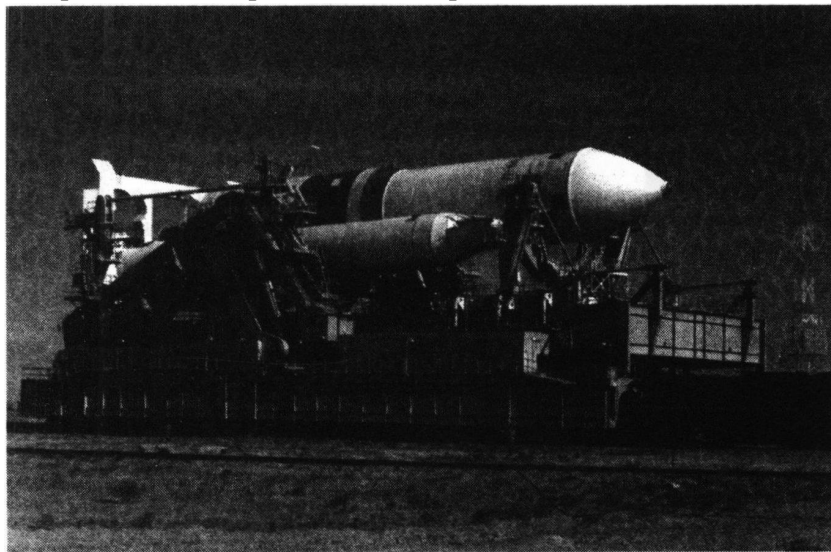
Made a new tank — test its strength, and not only on a regular stand, but also on a cryogenic one. And not only confirm the strength calculations, but also test it to destruction to determine its survivability. A new valve appeared — be kind enough to conduct appropriate tests, from design to reliability confirmation. There are differences in the engine operation cyclogram — test it on the fire stand more than once, gather at least a small amount of statistics.

Rocket scientists were accustomed to such strict laws. They understood well that it was impossible to interfere with the operation of systems, units, and engines during flight. One could only issue a command to destroy the rocket. And, for example, to understand why a valve did not work and what needed to be done to fix it, there was simply no time, and no ground means for analysis and intervention.

That is why the scheme for exiting an abnormal situation is thought through a thousand times during the design phase. That is

why the main elements of the pneumatic-hydraulic schemes of propulsion systems are duplicated, that is why electrical elements are triplicated, that is why computing complexes, or simply computers, are not only triplicated but also built on the principle of deep majority voting.

And despite autonomous, complex, and fire tests that confirm everything is fine, rockets still fall. Then emergency commissions begin to work. Their task is not only to find the cause but also to develop measures to prevent such repetitions in the future.



Transportation of the Energia-M launch vehicle to the UKSS

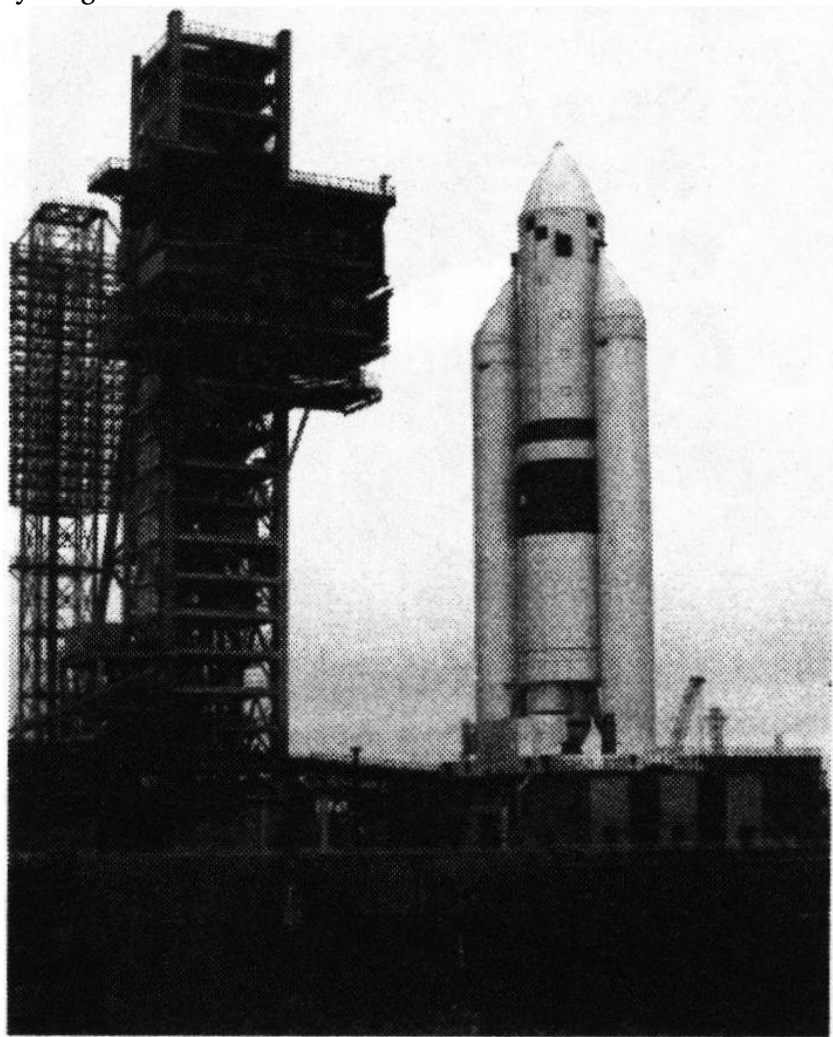
And what is working in commissions? It is, first of all, enormous nervous tension. And friends-colleagues sit next to each other and begin to clear their names, each in their own way. And it also happens that one can blame a neighbor. Sometimes they quarrel so much that it's sickening to look at each other. But when they get to the truth, and the culprit takes responsibility for the accident, then the others feel relief. And again, everyone is friends and they start advising what to do.

I myself often had to work in these commissions. I understood one and the most important thing: that technology can be neatly organized, but personal grievances are unacceptable, and attacks on partner companies, accusing them of being all fools, are also unacceptable. This is not forgiven, this is also one of the laws of rocket scientists. Whatever happens, do not offend the honor and dignity of your colleagues and their enterprises. Work has bound you to them, and work for your entire life. This is where people's characters are tested. This is how a whole galaxy of rocket scientists has formed in the country, ready to come to each other's aid.

The mock-up rocket was placed on the launch device. The

communication lines and service platforms were fitted to it. The launch equipment fit perfectly. Ready to fuel and launch tomorrow.

But we understood well that if the ground systems were ready for this, the path to the rocket itself — the flight model — was still very long.



Energia-M launch vehicle installed on the UKSS

The political situation in the country changed dramatically. Without the Union, there were no government decrees, and the country had no need for such a launch vehicle.

— If you need it, then you create it, — we heard roughly such answers in the corridors and offices of power.

New leaders frequently visited Baikonur. They were simply delighted with what they saw, saying repeatedly that it couldn't be abandoned, that it was a crime, that the assembly and testing facility and the launch pad were in such a deplorable state, that

history would not forgive us if we didn't preserve what had been created and use it.

I clearly remember the visit of V. F. Shumeiko, then chairman of the Federation Council, to the test site. He, along with Yu. N. Koptev, toured all the Energia-Buran facilities.

— We will not allow Baikonur to be buried. Soon there will be a Council of CIS countries, I will raise the issue there.

I wonder what question he raised there?

For the launch of the Kazakh cosmonaut, N. A. Nazarbayev invited the leaders of the independent Commonwealth countries. Besides the Balts, the new presidents of Ukraine, Moldova, Armenia, Uzbekistan, and other former republics arrived.

The delegations were shown, in turn, the former achievements of the Union. Everyone admired them, made good entries in the guest books, and said that everyone was ready to participate on a shared basis in space programs. But they dispersed to their own states and all got bogged down in their own problems, and no one cared about space anymore.

Foreign leaders also became frequent guests at the cosmodrome. They, too, were impressed by what had been accomplished. They saw firsthand the former power of the Union.

I remember well explaining things to the Chancellor of Austria, Mr. Vranitzky. He nodded his head, as if understanding everything, and then said:

— You need to learn how to sell your products.

For me, a technical person, this was a complete revelation. We were taught how to make rockets, but how to sell them?... We needed to change our way of thinking. To find out who needed your rocket and why.

A painful search for a payload began. But all users did not want to invest money in its creation. Everyone wanted to use only a ready, well-developed rocket.

In 1992, a space agency was created in Russia, destined to form the country's space program. Yu. N. Koptev became its head. It was with him that we started Energia, and his personal energy and conviction allowed the creation of the Russian Space Agency. Our former ministers and other deputies somehow crawled into commercial structures. And only the former deputy minister Yu. N. Koptev picked up this space flag and began to raise it from oblivion.

The first federal space program was being born. Everyone rushed to take their place in it. This included communication satellites, satellites for national security interests, spacecraft for planetary exploration, and a manned program, with launch vehicles as a separate section. It was into this section that we managed to

get. However, there was clearly not enough financial means to create the launch vehicles.

I don't want to criticize this program, but it included general sections, such as maintaining the reliability of operational products or maintaining the infrastructure of ground systems at test sites. In my opinion, this simply dispersed funds that were limited. There was no single policy for creating new systems, apparatuses, or rockets; instead, there was a policy of survival for numerous institutes and design bureaus.

All developers and manufacturers of rocket and space technology rushed to the RSA. Everyone wanted to cut a piece of the pie for themselves.

To be fair, it must be said that the manned program took the lion's share of the funding. After all, being a space power without the Mir space station was simply unthinkable. Plus, there were contracts with foreign countries for conducting research by cosmonauts from those countries. This was already a political issue. The leaders of the RSA understood this well, and the new leaders of the White House also understood that space programs would prevent Russia from falling into the third world. All this, as they say, is a different matter. Let's return to our Energia-M. When a new rocket is created, according to a long-standing tradition, the rocket is tied to a complex. As a rule, these were military complexes, and practically all rockets, except for the lunar N-1 rocket, were developed according to the tactical and technical specifications of the Ministry of Defense. This is how the legendary R-7 rocket, the Proton rocket, and the reusable Energia-Buran space system were created. Only when the rocket "flies" is it used for scientific and commercial purposes.

So, it comes down to which came first — the chicken or the egg? We argued that all payloads for the Proton launch vehicle could easily be adapted to our rocket. No one doubted this. But the developers of the spacecraft could also be understood — why put it on a new rocket when the task could be solved with a well-proven rocket. The search for allies yielded nothing.

Our enterprise began to offer a new complex based on a small universal space platform. But the niches: communication, navigation, television, space situational awareness in the interests of the Ministry of Defense, and other areas were already occupied by spacecraft developed by other enterprises.

— If you want Energia-M to live, find a payload, — Yu. N. Koptev told me more than once during our meetings. — The rocket must be created, — he continued, — this will help support Baikonur. And we are not going to leave there in the foreseeable

future.

— And what do you propose?

— I already said what needs to be done. This will support our design bureaus, factories, and institutes.

By this time, it so happened that our organization was corporatized. And although the controlling stake was held by the state, everyone understood that we had become independent and had to survive autonomously.

Having created the RSA, Yu. N. Koptev was “worried” about the enterprises that were under his direct subordination, and these were, first of all, research institutes.

All my attempts to somehow increase the volume of work did not receive understanding in the RSA, and accordingly, no funding.

— Let me make two tanks. After all, only two tanks, the rest is there: both engines and the first stage, — I told the leaders in the RSA.

— But you understand that we cannot dismantle the ground infrastructure for Energia-Buran. After all, you need it. Without ground support, you won’t launch the rocket.

— Yes, but first we need to build a rocket that can be launched. Otherwise, what’s the point of all these facilities?

— And they won’t be restored later.

— So let’s build the rocket quickly. The facilities won’t have time to fall apart. Because if we give funds by the teaspoon, we will stretch the creation over decades, and all the time we will support the ground infrastructure. That’s huge money.

— We have a spoon, but no money.

— There will be a rocket, and then it will help to get them itself.

— You know, you’re worried about the rocket, and we’re thinking about how to pay salaries to our institutes. You are independent, so take money from other projects.

— How’s that?

— Like this. You have manned spaceflight, you have international commercial orders, so take some money from there for this project.

— There isn’t enough money there either.

— You see, and you want us to abandon our enterprises.

— No, that’s not what I want. I want the available funds to be spent rationally. Anyway, all, as you say, your enterprises receive money, so it’s better if they receive it under a program.

— We gave them under the program, and you figure out how to build the rocket.

I had such dialogues more than once at the space agency. I

realized they were useless. A new term began to emerge — enterprises must survive. Sometimes it's simply surprising how high-ranking leaders didn't understand that a return to the old system was not foreseen in the near future.

It was necessary not to survive, but to quickly learn to live in a new way, and some directors understood this. They rushed to find a market for their products. This turned out to be a very difficult task, as by this time the space market was already divided. This, however, is another topic and a very interesting one, how Russian enterprises literally fought their way into this market. But only those who already had ready-made space products fought their way in. What about new ones? After all, the customer's first concern was the flight reliability of the products.

We, referring to both the RSA and other government agencies, were too greedy to invest in a new rocket. And it is well known that a stingy person pays twice. Without state support, it is simply impossible to create a space rocket. No one in the world has succeeded in this: neither the Americans, nor the French, nor the Japanese, nor the Germans.

Our Energia-M project was good in every way, but we were simply too far ahead of our time. It was later that systems like Teledesic appeared, for which the Energia-M launch vehicle was the most optimal. After all, in terms of cargo compartment volume and payload mass, it could have been unsurpassed, and in terms of the cost of the launched cargo, it would have had no equal.

One can only regret this now. The project was launched, the necessary schedules were released, and 90% of all working documentation was completed. The factory's technological services began preparing for production. We rushed to find foreign customers. We even went so far as to give American firms the exclusive right to launch spacecraft using Energia-M, which was not entirely serious. But events in the country did not allow the project to be supported. The general crisis of industry, including the rocket and space industry, and the policy of survival took their toll. We reached a stage where production needed to begin, and these costs were an order of magnitude higher than design costs.

All the money disappeared somewhere. On television and radio, all we heard was: "Miners have no wages, teachers have no wages, no wages..."

In this regard, interest in Energia-M also began to wane among the enterprise's leaders. As they say, you can't break a log with a whip.

It was necessary to find new ways, new approaches, to restructure our thinking, to find our niche in the rocket and space

business.

P.S.

No high-ranking government official has dared to sign a decree to close the Energia-Buran project to this day.

I recall the visit of Russian Foreign Minister A. V. Kozyrev to Baikonur. He was delighted with what he saw. When N. I. Omysova approached him and asked what needed to be done, he said:

— Payloads are needed.

— And if there are none, then close it.

— There is no such person in the government to make that decision.

DIGRESSION

It is very difficult for a technical person to imagine that everything in the world can differ from the laws of physics or chemistry. True, chemistry is closer to mystical transformations. A technical person sees a logical continuation of their thoughts in another and wants their associate to act as they wish. And if the associate's actions do not correspond to the logical representation, then they seem strange.

In our souls, we are all egoists and, of course, consider ourselves gifted, or even geniuses. Sometimes we think that the world revolves around us.

Life arranges everything in its own way. Beliefs, tastes, and views change over time. One is explained by the information received, the other by physiological changes. But all this says that there is nothing stagnant in the world; everything changes. And no matter how much we wanted to, no one has managed to stop the moment.

A person tries to grasp as much as possible in life, tries to reach heights they dreamed of since childhood. They reach a certain stage, and before them again is an endless abyss of the unknown, and again the desire to learn even more captivates them.

I had to communicate a lot with very different people, mostly technical people. Each of them is, of course, an individual. Each has their own views, habits, and approach to solving technical issues. Today, people believe in horoscopes, believe in fortune-tellers and predictors. But each person still acts in their own way. Everything depends on their culture, education, and strength of spirit. They claim genius for themselves!

A well-known example in our industry is when the head of a reputable enterprise, already convinced of his genius, literally started every working day with a shot glass and by lunchtime was in such a "warm" state that he could not talk. And this continued not for a day, nor a week, nor months, but years. The enterprise was on the verge of collapse, and he kept drinking, drinking... And no one managed to remove him from office. And he literally dealt with his subordinates: he removed this one from office, he fired that one altogether. And he got away with everything.

But the enterprise, surprisingly, existed, and people worked, and products were produced. Even if small, they were produced. This meant that the team was healthy. People believed that all this was temporary. With such hope, they came to and left work. We

want to bow low to such people who were among our main co-contractors. Such an environment forces one to rethink their behavior.

SEARCHES

The search for joint projects with foreign partners increasingly became the concern of the enterprise's management and our General Director. At that time, the enterprise simply lost the support of the Ministry of Industry. Former union ministries such as general machine-building, aviation industry, just machine-building, chemical industry, and a number of other ministries merged into this ministry. They created such a monster that officials did not have time for individual enterprises.

It was good that the Russian Academy of Sciences remained or was revived. A special department was created under it, which oversaw aviation and rocket technology.

At one of the meetings in the late 80s, our colleagues from Tushino, working on the "Buran," proposed a project for delivering cargo to Earth's orbit using aircraft systems.

It consisted of the following. The world's largest aircraft, the "Mriya," carried a small aircraft with rocket engines on its "back" to the equator. It accelerated eastward, detached the orbital aircraft, which then launched the payload into space. The project was named "Max." The "Mriya" returned to its airfield, and the orbital spacecraft, having completed its mission, landed independently. All this seemed very labor-intensive. To create such a complex for a few tons, and only to use the Earth's equatorial speed.

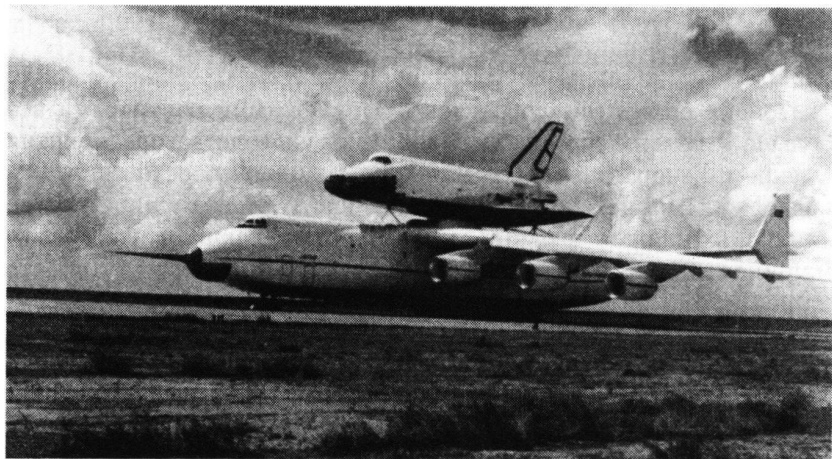
"Or maybe by sea?" our General Director expressed his thoughts.

"That's a good idea," Academician E. P. Velikhov picked up, "and not so stressful."

Upon returning to the enterprise, the General Director gathered the designers and our ground crew and gave them this task.

"I'm going to the States soon to Boeing. Before I leave, prepare a small engineering note on sea launch."

G. N. Degtyarenko and V. M. Karashtin received the assignments. The work was completed on time. A small note was written.



Orbital Vehicle "Buran" on the "back" of the "Mriya"

It presented various schemes for sea launch: from large tankers and from semi-submersible platforms. All this was considered for the "Energia-M" rocket.

We didn't know then that the Ministry of Defense of the USSR had tasked the Yuzhnoye Design Bureau and TsNIIMash to conduct such a study for the "Zenit" rocket. The study showed that such a project was unprofitable and practically unrealistic. At that point, interest in sea launch disappeared.

Taking our study and other proposals, the General Director went to distant Seattle.

Upon his return from the USA, he gathered us.

"I have agreed with Boeing that we will jointly work on five topics to find common ground. We assisted in securing the international station contract for Boeing—this is our first topic for discussion. The second is related to the use of low-flying satellites. For us, this is 'Signal.' The third topic is joint scientific experiments, the fourth is monitoring, and the fifth, strangely enough, is sea launch. I absolutely did not expect such enormous interest in sea launch. We will create five working groups for these areas. A delegation from Boeing will arrive in April to work on these areas."

The groups were immediately created. I was appointed the head of the "Sea Launch" project from NPO "Energia."

The meeting ended.

"Filin, stay. The Americans suggested using 'Proton,' but I convinced them there would be big environmental problems. And 'Proton' is tied into our company 'Lockheed-Khrunichiev-Energia.' So I suggested considering 'Energia-M' and 'Zenit.'"

"Zenit"?!

"Yes, Zenit."

"But then we need to agree with the Yuzhnoye Design Bureau."

“Of course, but that’s later. That’s my question. You review the technology with Boeing and estimate the project cost.”

“Understood the task.”

On a beautiful spring day in 1993, a large delegation from Boeing, led by Vice President R. Grant, arrived at our design bureau. There were about 20-25 people in the delegation. In addition to technical personnel, R. Grant also brought lawyers. Agreements had already been reached on some topics. But for “Sea Launch,” an agreement was still far off. Vincent Callori began working in the “Sea Launch” group from Boeing. A colorful American. A lean, athletic gentleman of about fifty-five.

We were provided with a separate room in the research center. Our enterprise rented an entire floor of a building in Mytishchi for meeting foreigners. This was the building of the Moscow Civil Engineering Institute. They repaired the right wing at their own expense. In this wing, in one of the rooms, we began our work. We exchanged business cards, and the work began. Each side acted very cautiously. The first day passed in mutual probing. My American colleague was more interested in how the Zenit rocket and the DM block were designed, while we were more interested in marine assets.

In those days, many of us were meeting foreigners for the first time, and everyone wanted to show that they were important. Therefore, they gave excessive information; sometimes, this information did not even correspond to the agenda of our meeting. I had to interrupt my colleagues more than once, who, to seemingly harmless questions from the American, gave such detailed answers, and he, with his charming smile, only encouraged them to speak more and more. He was especially interested in the propulsion system of our upper stage. It was indeed unique.

Working with me from our enterprise were L. B. Prostov, V. V. Liberman, A. N. Shorin. Vincent Callori had two assistants. Vincent himself was an expert in liquid-propellant rocket engines. He designed the engines for the giant Saturn-V rocket. This rocket delivered the first astronaut to the Moon. Hence such interest in our upper stage engine, which, due to its design, had a specific impulse that Americans could only dream of. Vincent noticed my firm stance on this issue, so he tried to ask questions when I left the room. I had to warn the guys again and tell Vincent directly:

“I propose that we conduct our negotiations on the project as a whole. When it becomes clear that everything will work out and we become partners, then we will answer all your questions.”

He agreed with this and from then on did not ask specific questions about the propulsion system design.

We were interested in what Boeing thought could serve as a launch platform in the open ocean. The Americans proposed a large tanker, already past its service life, with a displacement of 250-300 thousand tons. They believed that a tanker could be bought relatively cheaply and neutralized in one of the Asian countries, as labor there is inexpensive. When asked about their attitude towards floating platforms, the answers were very vague. We followed their path. We began to discuss what the project's financial costs might amount to. At that time, we were only making our first attempts at developing business plans, and today it seems ridiculous. Estimates showed that the cost of creating a complex that would ensure the launch of the Zenit rocket with the DM upper stage would be around 850-900 million dollars.



On the right — Vincent Callori

"The project is interesting, but its cost is enormous; my management will not agree to it," said Vincent, "we won't be able to explain to our shareholders that such money can return with profit. And you also have such an unstable political situation."

Everything seemed to be going well, and then this. My group would bring nothing to NPO. I didn't know how things were in other groups, but ours was simply failing. In the ensuing silence, thoughts raced faster than electrons. What to come up with? How to get involved in the project?

"Listen, Vincent, what kind of cost are we talking about?"

"I think it's 250-350 million dollars."

"How old are you?"

"Fifty-eight."

"And how far are you from retirement?"

“No, it’s already on the horizon.”

“If you are designated as responsible for this topic by Boeing, then you should not let it fall apart.”

He thought about it.

“I propose we tell our bosses now that the project can fit within 320 million. After all, our estimates can be refined. I think it’s possible and necessary to calculate it again. We will look at the rocket equipment, and you will look at the marine equipment.”

“I agree.”

Everything inside me relaxed. Now I had to solve the second problem: how to get money for our enterprise for such a study?

“We will complete the work in three or four months, but we will have difficulties with financing.”

“I will give 50 thousand for this study. It’s within my power,” V. Callori suddenly became important. “I am a member of the corporation’s board and I think I am respected. I am ready to sign the document.”

The document was born quickly. Just one page. One copy was printed in Russian, the second in English. We signed it, and right there in the room, we treated our guest to Russian vodka and presented souvenirs. The beginning was made.

We returned to our respective enterprises. Each of us reported to our leader.

“How are things with you?” the General Director greeted me with a question.

“Well, it seems okay. We discussed the options, and I think V. Callori will convince his superior that the topic is promising.”

“There’s no doubt about that. It would just be good if this whole endeavor was technically sound.”

“They (the Americans) also liked it. They only express doubts about the project cost.”

“This issue needs to be carefully examined and definitely linked to the technology.”

“They allocated 50 thousand dollars for additional research on ‘Sea Launch.’”

At that time, this was a huge amount of money for us.

“Boeing wants us to optimize the rocket equipment, and they will see what the marine part will cost. Initial estimates show that the project price could be 300-350 million dollars.”

“Why so much?”

“Ours turned out to be more. But we agreed that if the price is high, the project is unprofitable, and Boeing’s management will not go for this project.”

“So, we need to find solutions.”

“That’s what we agreed on.,,”

“This project will be the project of the century. This is the first huge commercial project. Launch from the equator! That offers a lot. And all on one or two ships. No need to build housing, have kindergartens, lease land, have exclusion zones for falling stages. This is work for our enterprises. We alone cannot handle this, but with Boeing, it can become real.”

It was clear that the project had deeply settled in his mind. He began to develop this idea further, turning it into a real embodiment. And the more he spoke about this topic, the more he convinced himself and others of the innovativeness and profitability of this project.

“How much time did you take for the study?”

“About three months.”

“What marine assets did Boeing propose?”

“They proposed a huge tanker. It would be both the MIC and the launch platform.”

“That’s dangerous. And what tanker, and whose?”

“They didn’t make specific proposals, but said that an old one could be found for approximately 30-40 million.”

“And how much does it cost to re-equip it for rocket purposes?”

“Only estimates so far. According to our calculations, the cost of marine systems and rocket systems will be approximately the same,” he avoided specific figures, well aware that our General Director remembered figures for a long time. Then you would have to prove their change.

“Well, alright, get to work.”

As a result of this American meeting, only three out of five topics found a concrete outcome. The management was very pleased. Especially with the connections regarding the international space station, where Boeing was assigned a far from insignificant role in the USA.

Some changes occurred at the company. Designers of space launch vehicles and lead designers of rockets and blocks merged into one service. This service began to deal with the creation of rockets, upper stages, and sea launch.

The development of rockets, primarily “Energia-M,” was sluggish, barely flickering, as they say, while upper stages of the DM block type were mass-produced. B. V. Chernyat’ev oversaw them. The first steps were only being taken in the commercial use of these blocks with the “Proton” rocket, and even there, the initiative was seized by the M.V. Khrunichev Filyovsky Plant. Therefore, the main effort, primarily of the designers, was directed at developing the “Sea Launch” project.

AN UNEXPECTED TURN

One day, a university friend from Minsk called me. He asked me to meet and show Moscow to his guests from South Korea. That's how I met Professor Che and his boss, Wright. I showed them Moscow. They had about six hours before their flight home. We exchanged business cards. This meeting was not in vain. About a month later, a call came from Moscow.

—You are speaking with the Hyundai representative office in Moscow. Our company's vice president has arrived and wants to meet with you.

—Why me?

—Professor Che recommended him to you.

—Where and when does he want to do this?

—As you wish.

—Better after work. And you decide the place.

—Then, perhaps, at our office?

—And where is it located?

—In the World Trade Center.

—Is that the "Hammer House"?

—Yes.

—At what time?

—Would 6 PM suit you?

—Good.

—You call this number (he gave the number), ask for Oryol. I will come out and meet you.

I laughed:

—Good. I'll call and say that Filin is waiting for Oryol.

I heard laughter on the other end too. We agreed on that.

Two days later, taking L. G. Firsov, as the executive director of "Enerm," with me, I went to the World Trade Center. We were trying to find additional work for "Enerm," and thus for the enterprise, keeping in mind financial matters unrelated to space. For this purpose, I took the lead and director in one person with me.

We were met, and we went up to the 16th floor. We entered the office. It consisted of three rooms: the representative's office, the negotiation room, and the employees' workspace. The presence of a computer for every employee immediately struck us. We didn't even dream of that back then.

We got acquainted. Chu turned out to be a very friendly man, about forty years old. It was clear that the office staff feared and

respected him. He spoke Russian quite tolerably.

—Professor Che told me about you. We are very glad to meet you. Our company is looking for serious contacts in your country; we are very interested in new technological materials.

He gave us brochures about his company. We were surprised to learn that Hyundai is one of the largest companies in Korea. Its activities are, first and foremost, the construction of ships, automobiles, and the production of other, no less important industrial and consumer goods. In the field of shipbuilding, the company ranks among the top in Asia and is among the ten leading shipbuilding companies in the world.

—We are also interested in the space sector. We are currently studying the possibility of creating a rocket direction.

—Let's start by introducing you to our enterprise, which deals with materials, and then we'll talk about other directions,—I began to avoid the specific question.

—Good.

—We'll call each other tomorrow.

—I'm in Moscow for a week.

By 1992, many foreign visitors had visited our enterprise. They would mill around, promise mountains of gold, and then disappear. This involuntarily caused irritation among the management.

Therefore, I decided to first check the seriousness of their intentions with concrete proposals. For this, the “Kompozit” enterprise, which had many different offers for the market, was perfectly suited.

I called the deputy head of the enterprise, my friend, Yu. G. Bushuev.

—Let them come. We'll receive them,—I didn't expect any other answer.

“Hyundai, Hyundai,” kept swirling in my head. “There's something here. It seemed to me that I had to discover something, something very simple and very necessary, to connect this firm in a single action with others. Again and again, I mechanically flipped through the company's brochures. I found it! After all, they are builders of sea vessels, and huge ones, including tankers, and our project needs a huge tanker.”

We are a space enterprise. Boeing is an aircraft manufacturer, but where is the marine aspect? It seemed to me that this would be very well received!

I went to the General Director.

—Yuri Pavlovich! There is a proposal to involve a shipbuilding company in the “Sea Launch” project.

—Which one?

—The South Korean company Hyundai,—I showed him the brochure.

He looked at the brochure.

—Well, that's an idea. We need to propose such an option to Boeing. We are obligated by protocol that if we invite partners to the project, we will coordinate these issues.

—I would first like to get approval to talk with Vice President Chu. Maybe they will refuse, and then, of course, we will notify Boeing, or maybe we will arrange a meeting.

—Go ahead, try. Don't reveal the details, but generally, try to sound out the ground.

The next day, a meeting at "Kompozit." The Koreans were shown the enterprise and given a book on the subject. The book, also printed in English, offered dozens of directions for joint work and contracts. Chu thanked them for the reception and promised to study all proposals in detail. During lunch, Mr. Chu expressed the company's desire to purchase a cottage near Moscow.

—We have one in mind, let's go,—Yuri Georgievich suggested.

A small enterprise had branched off from "Kompozit" and was engaged in construction somewhere in Bolshevo. After lunch, we went to see it. The Koreans nodded politely but avoided concrete proposals. On the way back, we stopped by Yu. G. Bushuev's friends and for a long, long time raised one shot of vodka after another "for the road." We returned to the hotel in a cheerful company. Grateful and at that moment good-natured, the Koreans presented Yuri and me with souvenirs—a bottle of Korean vodka each, with a snake preserved in alcohol inside the bottle. We parted ways on that note.

The next evening, I met with Chu. He had recovered from yesterday but looked tired.

—I have a serious proposal.

Chu looked up at me:

—What is it?

—Can your company build huge ships, tankers?

—Yes, of course.

—What if we offer you to participate in a project where your ships will be involved in rocket launches?

I briefly explained the essence of the project.

—I need to consult. Can I answer tomorrow, or better, in two or three weeks? I have to fly to Seoul for other matters and then return, and then I will answer.

This suited me. In two or three weeks, R. Grant was supposed to be in Moscow. I thought that if Chu agreed, we would organize a meeting in Moscow.

Our departments were becoming more and more involved in

the work on the topics. Many among the leadership did not believe in the project, considering it the General Director's amusement, but its novelty and technical complexity made it increasingly attractive.

These weeks flew by quickly.

R. Grant arrived in Moscow. Again, a warm welcome for the esteemed guest at NPO "Energia," again assurances that we must go forward together. The results of the work on previously agreed topics were reported. My report was last. I said that the project was technically feasible, and presented the issues that needed to be resolved. We had discussed them with the management the day before. I proposed that to accelerate the project, a "marine company" should be involved, specifically, there was a proposal to involve the Korean company "Hyundai."

R. Grant became wary:

—Have you already made them an offer?

—No, of course not. We cannot do that without you,—the General Director replied,—we only asked them preliminarily if they would like to participate in a large project. It seems they don't object. But the final word, of course, is yours.

R. Grant calmed down. But his anxiety also did not please us.

—By the way, the vice president of Hyundai is currently in Moscow; I could organize your meeting,—I suggested, looking at the General Director, to R. Grant.

—Good,—he accepted the offer,—when and where?

—Whenever it's convenient for you. It can even be today.

—Then at the Slavyanskaya Hotel at 6 PM,—the instruction was firm.

After calling Chu, I told him that a meeting with the vice president of Boeing was necessary regarding the matter of interest. He agreed.

Five minutes before the appointed time, we were in the lobby. R. Grant was staying at this hotel and precisely at 6 PM, he came down in a luxurious suit with an interpreter.

—Let's leave them alone,—the interpreter suggested after I introduced them to each other.

—I agree. They will understand each other faster.

We sat at tables in the hotel lobby. A pianist played softly and melodically. We ordered a cup of coffee each. Nearby, at another small table, the vice presidents were seated. R. Grant settled comfortably in a soft armchair, asking Chu something. And Chu increasingly began to resemble a mischievous boy. The conversation lasted about forty minutes. Then the vice presidents stood up and approached us.

—The conversation was very useful,—R. Grant said, smiling

softly, indicating that the meeting was over.

We left the hotel and got into the car. It seemed to me that Chu finally exhaled.

—Well, how was the conversation?

In response, he mumbled something and remained silent until the hotel.

At the hotel, Chu thanked me for the meeting and said:

—This is a very serious project. Maybe it's beyond our capabilities.

—But you only build ships,—I didn't understand what he meant.

—This is a very serious project,—Chu repeated.

We shook hands and said goodbye:

—See you soon.

—I don't know if it will be soon,—he replied.

In the morning, R. Grant flew to Korea instead of America. What urgently took him to that country remained a mystery. About a week later, I heard a phone call.

—Is this Mr. Filin?

—Yes.—I heard a familiar voice on the line.

—This is Chu speaking. I must say that we will not be able to participate in the project.

—Why?

—We will not be able to participate in the project.—Chu hung up. I never heard from him again. It seemed R. Grant's visit to Seoul was fruitful for the Americans.

About a week later, Yu. P. Semenov called me.

—How are things with the sea launch, anything new?

—We're still working. We looked at options. We want to make a universal launch for both "Zenit" and "Energia-M." It's not working out yet.

—R. Grant called, he's interested in how the cost studies are progressing? Better come in, report, and we need to talk.

I went to see the General Director. He was in a good mood, which was conducive to a constructive conversation. I told him what had been done to study the project and that Chu had called.

—Well, I'll be,—Yu. P. Semenov was surprised,—he didn't even hesitate to fly so far. Something's not right here. They probably want to trick us. But into what?—And, as if answering himself, he added,—There's a lot we still don't understand in this capitalist world. We're just entering this market economy. They can still take us with bare hands. That's why they don't want a third partner to appear. Unfortunately, we have nowhere to go. We'll have to play their game. The project is too tempting. A beautiful project. We

need to work.

The project, indeed, was attractive from all points of view: as innovative, as technical, and as social.

But the thought of what had so worried the Americans never left me.

CONTINUING THE SEARCH

All our concerns were about finding work not only for us, but also for our branches. The Volga branch was focused on missile development. But the Primorsky branch, the brainchild of Academician V. P. Glushko, was left without work. This branch used to be a test stand base for engine testing, and then for rocket blocks. It was this base that allowed the testing of fluorine engines. The development of a combined propulsion system for the orbital spacecraft was carried out at this base. The production of new rockets in the country was curtailed, which meant there was no need for new engines, and therefore, a modern, well-equipped technical base became unnecessary.

Vladimir Vladimirovich Elfimov made enormous efforts to find work. He was going to use his

production facilities to repair and assemble foreign cars, wanted to create a transshipment base for petrochemicals, build a modern woodworking plant, manufacture plastic windows, etc. His plans were not destined to come true. He passed away early. Young Sergey Konstantinovich Petrov came to his place. The search for work continued.

The location of Primorsk on the shore of the Gulf of Finland led us to think about using our branch in a new project. Its production facilities could well be used for pre-assembly, storage of rocket blocks and upper stages. V. N. Bodunkov went to Primorsk for reconnaissance. Four days later he entered my office and said from the doorway:

— Vyacheslav, what I saw there!

— What?

— Do you remember, we wrote a small engineering note on “Sea Launch”, where we analyzed the use of semi-submersible platforms?

— I remember.

— Well, such a platform stands at the pier of the Vyborg Shipyard. S. K. Petrov and I went from Primorsk to Vyborg and there I saw it. Such a giant! It’s visible from everywhere. Sergey Konstantinovich introduced me to the director of VSZ, Georgy Alexandrovich Poryadin. We went to him, he said that this platform is the “Odyssey”, that it had burned and his factory restored it. You have to see it. You can’t just tell about it.

— We need to report to the General.

After the report, the General gave the go-ahead to visit Vyborg.

This was August 1993.

V. Kallori arrived in Moscow with his wife for further discussion of the project. He combined his trips as both business and tourist. We met them.

I offered him a trip to Vyborg to see the platform. He met my proposal without enthusiasm.

— We have Leningrad, and now St. Petersburg — a historical place, let's see the city, the museum, I think you won't regret it.

The proposal was accepted. A whole day of phone calls to Leningrad, Vyborg, organizing the meeting, and in the evening we were on the train. This was on the eve of those August events, when the question of power in our country was being decided. We were alone in the sleeping car. The train was more than half empty.

We arrived in Vyborg. S. K. Petrov met us. Transport was provided, and we immediately went to the factory. The director was away. His deputy received us. We went to the platform. It struck me with its size. Such a giant! I had somehow abstractly imagined its dimensions: height 35 meters, width 70, length about 100 meters. But when I saw it and connected the idea with reality, everything took on a completely different meaning. V. Kallori looked at everything with skepticism. Nothing seemed to surprise him. But he carefully inspected all the compartments. He didn't hesitate to climb to the very top deck.

— A big vessel, — was all he said, but he refrained from further comments. We decided to have lunch in Primorsk at S. K. Petrov's place. An hour's drive, and we were at our own enterprise. We went into S. K. Petrov's office. The TV was on. We didn't pay attention to it. S. K. Petrov began to talk about the enterprise and what it could contribute to the success of the "Sea Launch" project.

— Look! The White House is on fire, — someone exclaimed.

Everyone turned to the TV. With horror I saw tanks firing at the White House, how the upper floors were enveloped in smoke, and then black soot. It was impossible to watch.



Sergey Konstantinovich Petrov

— You promised lunch, — I said to Sergey.

We felt somewhat uncomfortable in front of the Americans about what was happening in OUR country. We needed to distract them somehow. So I suggested having lunch. Everyone immediately stirred and went to the exit. We quickly drove around the territory, looked at the assembly and test facility, the stands. V. Kallori showed a purely technical interest, as a former engine specialist. He said nothing about using the base for maritime affairs.

A hearty lunch — and on our way.

In Leningrad, Yuri Borisovich Sadomov met us. I knew him from our work on “Energia”. It was his ground electronic systems that ensured the preparation of the rocket at the launch pad. A

short city tour for Vincent's wife's delight. A cozy restaurant with Western service, and then the train again.

— What's your impression?

— Good. Especially the dinner.

— I'm not talking about that.

— Everything needs to be looked at carefully. The rocket and the platform need to be technically linked. For now, I have more questions.

— Agreed, but this option can be taken as a basis.

— I don't know, — he again avoided answering.

Upon arrival, I reported to Yu. P. about our trip.

— So what about this platform?

— I think it will be difficult to explain. You need to see it personally. I had one idea, and now it's completely different.

— Will there be enough space for the rocket?

— There will even be some left over. We need to check.

— Yes, we need to. But when? We need to make time. So you're saying it's suitable for the project?

— I think it's very good. We will work on it more specifically.

In Vyborg, we took sketches of the platform. We need to draw them up, and then we will report additionally.

Work on the project became more defined. For us, technical people, it was important to link everything from an engineering perspective. We often didn't understand Americans when they could abstractly discuss project management and economics without technical linkage. Technology was secondary to them.

The main thing they cared about was that their interests were not infringed upon. And technology — that's the engineers' business, they'll do it.

About a month later, V. N. Bodunkov calls:

— You know, G. A. Poryadin — director of the Vyborg Shipyard — and the vice-president of the Norwegian firm "Kvaerner" are in Moscow. They are staying at the Savoy Hotel, formerly the "Berlin". They came on their own business. But G. A. Poryadin strongly advises to meet.

— Arrange a meeting for tomorrow, around 10 o'clock.

Thus, the next day, the first acquaintance with representatives of the Kvaerner company took place.

Having ordered a minibus, we were at the Savoy the next day. Georgy Alexandrovich Poryadin met us. He also stayed at this hotel. We went to the Norwegians' room. To my surprise, there was a youthful woman in the room who spoke Russian well. We got acquainted.

Irina Grigoryan, as our new acquaintance was called, acted as

an interpreter. As we later learned, she herself was from Ukraine, worked for a long time in Murmansk, where she met the Norwegians, and then went to Norway under contract, where she became an interpreter. This Norwegian firm had quite a lot of connections with Russian firms. Basically, these were connections related to maritime and gas affairs.

Irina introduced me to the vice-president of this firm. “Per Herbert Kristensen,” he introduced himself. Later we just called him Per.

He laid out his company’s brochures in front of us and spoke at length and convincingly about its activities. We listened without interrupting, but from his tone, we understood that he already knew what proposal we had come with, and he tried to convince us that his company was no less famous in the West for maritime affairs, and that the company held one of the leading positions in Europe in shipbuilding.



Georgy Alexandrovich Poryadin

Finally, he fell silent, as if to say: now — your turn.

I briefly described the essence of the project, said that I had seen the “Odyssey” platform, and that a lot of work needed to be done. At first glance, it seemed suitable for the project.

— I need to get acquainted with your company, — Per said, as if the question of our proposal for his participation in the project had already been raised.

— Good. We can do that today. Right now. We have a minibus, we can go. I just want to warn you that we are not the only ones deciding on participation in the project, but with our American colleagues. We have an agreement on this matter. But to see the

company — please.

— I understand that you are bound by obligations, but if you say that the platform fits well into the project, then we will resolve all formalities together with you. Allow me to present you with our small souvenirs.

He took out a package and pulled out a box of Martell cognac. We exchanged glances; we hadn't expected this. Usually, simple souvenirs were given, but here — expensive cognac.

— We don't do that here. Let's open it and drink together, for our acquaintance, and without waiting for an answer, he opened the box and uncorked the bottle.

There was no way out, dishes were found. Fortunately, the room was expensive. As it turned out later, it cost 170 dollars per day. We had only heard of such brands of cognacs. The aroma was magnificent and the taste was also not inferior. — Don't be shy, — Irina said, — take the rest with you, treat your own.

Having given our small books in return, we left the hotel. Our minibus was not the best.

The shabby "Toyota" briskly sped off to Podlipki. We were met by representatives of the security service, whom I had warned by phone.



Per Herbert Kristensen

We went to the assembly shop. I showed them the assembly of upper stages, then the museum. The museum aroused great interest in the Norwegian. When Per saw a one US dollar bill in the display case under glass and the inscription below it, stating that it was the

first dollar received by NPO "Energiya" from the Americans for the "International Space Station 'Alpha'" project, he took out a red hundred-kroner note and said:

— I want Norway's contribution to be kept in your museum too. I think we will join the project. I would like to meet your leader, — he expressed his wish.

— That's not so easy to do. His schedule is packed to the minute. I didn't arrange a meeting with him in advance. If you're lucky, you'll meet. I'll call now.

I dialed the General's number. He was there.

— Yuri Pavlovich! I brought the Norwegians to our enterprise. Very interesting people. They can be useful to us in the "Sea Launch" project. Can you receive them?

— I have about ten minutes now. Come in.

What luck! I invited the guests to the General. Per straightened up. G. A. Poryadin whispered to me that he had "taken the bait," which meant he would convince the General that they were needed in the project.

We entered the office. I introduced Per and G. A. Poryadin. Irina translated. I must give her credit — she did it professionally.

Per again spoke at length, and I would say tediously, about his firm. The General glanced at his watch, and this, finally, did not escape Per's attention. He presented his souvenir and expressed hope that they needed to work together.

— I'm not against it, — Yu. P. replied, — but we have obligations to partners whom we must inform.

— That's right, — Per replied, — I suggest we meet together, say in Turku, and you can see the platform at the same time.

— Oh, that's an idea, — the General picked up. — We need to think about it. I have absolutely no time.

— This trip will take one day. I was told that you have your own planes.

— Okay, let's think about it, I have a "window" on November 25th. Does that suit you? That's about 2 weeks from now.

We agreed on such a meeting. I received an urgent command to notify R. Grant.

Our A. L. Martynovsky received a command to prepare the plane for Finland.

— And do we know how to fly there? — Yu. P. doubted.

— You gave the command. So we'll fly. The plane is certified, the pilots have all the documents for international flights.

One can simply marvel at this man. For him, it seemed, nothing was impossible, and I was convinced of this more than once.

DIGRESSION

At the institute, we were instilled with the idea that we were being trained as engineers, production commanders, and that the most important thing was to focus on achieving the ultimate goal. To us, it seemed like hitting a target with a rocket, launching an artificial Earth satellite. Or landing on the Moon, a soft landing of a spacecraft on Earth. It seemed everything was subordinated to this very goal. Everything else was service. This included the work of our ground crew, launch personnel, builders, and power engineers—everything was subordinate to the ultimate goal. And when you are there, at the very cutting edge of achieving the goal, you get maximum satisfaction from your work. You swell with pride for what you've done, all participants respect you, and even those who know about your deeds by hearsay revere you. It seemed to me that this was only possible in aviation, rocket, and nuclear technology. But what about builders? What satisfaction do they get? Not the builders who construct residential buildings. That's all clear. People move in, the lights of your home come on, you look and rejoice at how much you've given to the people who received their apartments in those houses. But what about our builders? Builders of technical, rocket, and space complexes, builders of roads, the cosmodrome, builders of launch facilities. What do they get from their work? After all, rocket launches will happen without them.



In rare moments of rest. Yu. P. Semenov, P. H. Kristensen, I.

Grigoryan, S. N. Konyukhov, Yu. A. Alekseev

I remember when the stand-launch for “Energia” was being built, General A. A. Fedorov asked me:

—Listen. Even if our stand isn’t ready yet. Can you bring the rocket? At least for a fitting, put it on the launch pad. Let all the builders see what they were rushed and driven for. This will be the best gift for them.

We brought the rocket then. We raised it vertically, fitted it to the launch table. There were so many people around! The entire diversion channel was filled with soldier-builders. They occupied all the high-rise structures. It was a clear, still warm autumn day. Everyone silently watched the rocket’s ascent, and in almost everyone’s eyes, one could see pride in their work. The cold, the heat, the dust storms were all behind them—everyone received their own, perhaps small, but a piece of happiness.

Our leaders always valued builders: S. P. Korolev, V. P. Mishin, V. P. Glushko, Yu. P. Semenov—all of them treated them with great respect, and as a rule, their first deputies were also the heads of the builders.

You are simply amazed when you see what they can do. Thanks to their energy, our enterprise was also transformed; G. V. Sovkov achieved and built a bridge connecting the first and second territories of our enterprise. I think there was simply no one else who could solve such a problem.

After all, the Yaroslavl highway was nearby, and there was no bridge over the railway yet.

Our enterprise was lucky to have such builders. A young A. L. Martynovsky succeeded G. V. Sovkov. It is his merit that the city of Kaliningrad, and now Korolev, received huge residential microdistricts. It is his merit in transforming the technical complex and achieving the level of the most advanced production facilities. Like oases in the steppe, buildings stand, inside which the finishing, cleanliness, and climate meet the strictest requirements of European and American standards. Everything that seems problematic, and sometimes impossible, becomes simple under A. L. Martynovsky. His level of thinking is not limited to small crafts, and if he undertakes something, he solves everything thoroughly and fundamentally.

—You set the task, and we will solve it,—I often heard him tell the General when he became the first vice-president of our enterprise. He organized an independent company from the flight detachment and made them earn money for their salaries. After all, before that, the detachment was unprofitable for us, and its expenses were included in the overhead for the main products.

Much was also done for the reconstruction of engineering premises, both at the testing ground and in Podlipki. It was thanks to his energy that the “Krepost” sanatorium in Kislovodsk began to operate.

Arkady Leonidovich devoted a lot of time to establishing useful connections with both the city’s “sheep” and the ministry, and with subcontractors.

If someone approached him, and he undertook to help, then consider that everything would be done.



Arkady Leonidovich Martynovsky

He looked far ahead and clearly calculated what would happen tomorrow, and as a rule, he never made a mistake. It was thanks to his initiative that our aircraft were certified for flights abroad; it was his initiative to train pilots and arrest them. Therefore, the command to fly to Turku did not catch him off guard. He was already ready for it. He had already mentally flown more than one international route. A former mountaineer, but having gained

weight over time, he showed enormous willpower to restore his health. And his vast connections in the art world often presented us with surprises in the form of wonderful concerts and individual performances for us.

Everything seemed to be resolved by him easily and effortlessly.

—No problem,—this was his favorite expression when any task was put before him.

THE PLOT

After the meeting at the enterprise, Per X. Kristensen flew to Oslo the next day.

In the morning, a call from the General:

— Tell R. Grant that we are meeting in Turku on November 25, 1993. We invite him to see the platform as well. There we will discuss the Norwegians' participation in the project.

— All right.

I prepared a fax. I indicated the company "Kvaerner." The plane was ordered. We were waiting for the consent of both Boeing and the Norwegians for this meeting. It was very tempting to see a specific vessel. If we were there alone, without the Americans, it meant that we would gain additional points, as perhaps we could do without the Americans. These considerations should push Boeing to fly. The Norwegians would also be there. Their platform, and the fact that Norway would become a space power, also suggested they would come. At least, that's what we thought. The meeting should not be disrupted. And indeed, a few days later, we received faxes from Norway and the States, agreeing to such a meeting. Everything seemed organized, but an inner feeling told me something was unfinished. I agonizingly wondered: what! I started to play through the course of the meeting and suddenly, as they say, it dawned on me. How to end the meeting? It's simple. As was customary for us, every meeting with co-contractors ended with either a protocol or a decision. So here too — a protocol was needed. It needed to be prepared in advance. But when? This simple thought came to me when I was already driving home, and tomorrow was takeoff. At home, I dialed Irina Grigoryan's number. A male voice answered in Russian:

— Hello.

— This is Filin from Moscow.

— Hi. This is Poryadin.

— How did you end up there?

— For business. I have many connections with Kvaerner on other topics.

Since there were practically no orders from Russia, he was scouring the world for work. When I asked him what his interest in the project was, why he started actively helping us, he answered simply and openly:

— If the project goes through, and it will, the platform will have to be modified for the installation of missile systems. And

where? — and he answers himself. — Of course, at VSZ. We had it. We know it well. Plus, we are Russia. Everything points to you coming to us.

Yes, his calculation was simple and businesslike.

— Listen, are you going to the meeting?

— Of course. I'll help however I can.

— I think a protocol or a meeting decision is needed. I'm assuming everything will go well.

— Yes, you're right. Let's think about what kind. Let's take an hour break.

— I'll write down the options, and you consult with the Norwegians, we'll call each other in an hour.

And so it began. I clearly understood that I was writing the meeting protocol without Boeing's participation. That's when I deeply regretted not knowing English. I thought everything would go without incident. After all, I was only writing a draft. I described the project as cutting-edge, that we would organize a joint venture (it was fashionable then), specifically a joint one. We didn't yet understand where to register it, how to minimize taxes. Yes, much was unclear ahead. I really wanted to make the project happen. It needed to be developed. This meant we needed to ask our future partners for money. After all, besides us, at least two dozen lead enterprises had to participate in the project. Developers of missiles, launch equipment, cryogenic equipment, installers, fittings, tanks, and our other good co-contractors were not in the best position. There were no orders, and people needed to be fed.

An hour later, another call to Norway.

We began to coordinate each proposal of the draft protocol with Irina and Georgy. We reached the financing part. It was already 3 AM in Moscow.

— I consulted with Per. He said that 10 million dollars should be allocated for the project development. Five million from Boeing and five million from Kvaerner. He arranged with President E. Tenset that he would not object. I almost choked in surprise. Good thing there's no videophone. I think my expression at that moment was quite something.

— Why are you silent?

— I'm thinking, isn't that too much?

— You write it down, Per said it would be, so it will be.

I started to ponder this wild, as it seemed to me then, figure. I understood only one thing: the Norwegians really wanted to join the project. At that moment, I didn't know that R. Grant was already in Oslo. He had been talking with Kvaerner's management for three days about how risky the project was, how

unstable the political situation in Russia was, and how we would support Russia's defense capability with the project. He practically convinced Kvaerner's management not to get involved in the project. But Per is Per. He began to insist on the meeting with great persistence. And the more arguments R. Grant presented, the more it fueled Per. As I understood, a gambler woke up in him, or he had always been one. I learned about this later, in Turku, from Irina.

The flight of the Norwegians, and with them R. Grant, to Turku for Kvaerner's management and R. Grant was more a matter of courtesy than business. Our visas to Finland had been processed. In the morning at Vnukovo-1 airport, A. N. Tinkov — head of the flight detachment — reported to Yuri Pavlovich that everything was ready for the flight. We passed customs and passport control. Again, V. I. Pyatkin lifted our Tu-134, and we flew directly to Turku. The service on the plane was excellent.

— Where did all this come from?

— It's standard for international flights, — A. L. Martynovsky said slyly.

On the table in the cabin, besides drinks, there were many snacks and fruits. We declined hot food. After a sleepless night, I went to the second cabin and fell asleep. The flight lasted a little over an hour.

V. I. Pyatkin masterfully landed the plane at the tiny Turku airport. Besides a small Gulfstream-type plane, there were no other aircraft around. Our Tu-134 seemed enormous.

— The Norwegians must have arrived, — Arkady Leonidovich suggested.

As it turned out later, it was indeed them.

At the airport building, we were met by the leaders of Kvaerner: President Erik Tenset, Vice President Diederik Schnitler, and, of course, Per X. Kristensen, Irina, and Georgy Alexandrovich Poryadin. Standing with them was the well-groomed R. Grant. Yu. P. Semenov, A. L. Martynovsky, N. I. Zelenshchikov, and I greeted them. Yuri Pavlovich introduced his team. Per introduced his. There was no need to introduce R. Grant to us or the Norwegians. The crew remained on the plane: they had no visas. Everyone completed the formalities, got into a luxurious bus, and drove to one of Kvaerner's enterprises located here in Turku. Upon entering the enterprise, we immediately went to see the platform. This giant stood in the bay. Everything around was white. Snow had fallen a few days earlier, covering the platform like a white blanket. We descended onto one of the platform's pontoons, carefully crossed to its stern. There was a ladder for climbing to the upper deck. Climbing 40 meters up a metal ladder was not easy. A. L.

Martynovsky, like a heavy mountaineer, only managed half the height. The others: Yu. P. Semenov, N. I. Zelenshchikov, Per, R. Grant, and Kvaerner's management, reached the final goal. The size of the platform amazed us, the newcomers. The General was surprised and pleased. His eyes lit up. He already imagined a rocket standing on the stern, ready for launch. He approached R. Grant and began to speak with admiration about the project. R. Grant listened politely, but there was no sense of admiration on his face; rather, the opposite.

— All this needs to be properly weighed and calculated, — was all he uttered.

We returned to the office. We went into a small meeting room. Per X. Kristensen again, now officially, introduced his leaders and spoke about his company. Then Yu. P. Semenov began to talk about the project, its obvious advantages, and as if by chance, he already introduced the platform into the project. R. Grant looked at Erik Tenset somewhat slyly and said that more work needed to be done. They discussed the participation of Boeing, Kvaerner, and Energia in the project.

At that moment, we had not yet decided on the rocket. The question of using Energia-M was being worked out, but the very first statements from our interlocutors indicated that they were not going to invest money in any new development. They were not going to strengthen our armed forces, and investing money in a new rocket might not pay off. Customers would not "sit" on a new rocket; they needed a rocket whose reliability had been confirmed by a dozen launches. This significantly narrowed our search. The Zenit launch vehicle came to the forefront. Its production was in Ukraine, but by equipping it with a third stage, which could be our DM rocket block, we would get a new rocket. Such a rocket could compete with Proton in terms of payload capacity to geostationary orbit.

Yuri Pavlovich took on the conversation with S. N. Konyukhov regarding the use of the Zenit launch vehicle.

— We have prepared a draft meeting protocol. I propose to read and discuss it, — I suggested to those gathered.

Everyone agreed. The General looked at me. He knew nothing about the draft protocol. I hadn't had time to report to him. I began to read. Irina translated each sentence. She tried very hard to translate literally. The general phrases passed quite quickly. R. Grant listened as if with half an ear. He was sure he knew how it would all end. I reached the point about further work on the project.

I read:

— NPO Energia, with its co-executors, will conduct a study of the project at the level of technical proposals (preliminary design) by March 31, 1994. Boeing and Kvaerner will finance this study in the amount of 10 million dollars, which will then be taken into account when determining each party's contribution to the project. Boeing and Kvaerner will make equal contributions to the development of the preliminary design, i.e., 5 million dollars each.

This sounded like a bolt from the blue. The General nervously fidgeted, looking at me disapprovingly. Nikolai Ivanovich Zelenshchikov calmed him down. One could understand Yuri Pavlovich; he didn't know about our nocturnal vigils, and therefore feared that this could be the last conversation about the project. R. Grant jumped up and smiled somewhat nervously, only saying:

— This is fantastic!

— We agree, — stated Kvaerner's president E. Tenset in a firm voice, — we like the project.

The General's face brightened, and R. Grant somehow slumped. He lowered his head and thought agonizingly about something. He understood well that he had fallen into a trap.

— I suggest we take a break. I need to discuss something with Kvaerner, — was all he uttered.

Per X. Kristensen stepped forward.

— I have a suggestion: show the Russians Turku's landmark — the old fortress. And we'll talk, then have lunch, and then gather here all together again.

Everyone readily agreed, and it was already around three in the afternoon. Again, a luxurious bus. A tour of the fortress. The medieval structure was striking in its scale. It gave the impression that the film "Hamlet" was filmed here. In one of the fortress wings, there was a small restaurant. That's where we headed for lunch. Everyone was hungry, and we were surprised that there was no alcohol on the table. Apparently, Finland is strict about this. We looked at each other. The Norwegians understood our glances. They whispered to the waiter. A few minutes later, two bottles of vodka appeared on the table for everyone. During lunch, the conversation was abstract, not touching on the project.

We returned to the office. Per X. Kristensen took the floor. He announced that, in principle, they and Boeing had agreed that a preliminary design was necessary and that they were ready to sign a protocol allocating 500 thousand dollars for project work in Russia.

Such a turn of events was no longer unexpected for us.

— We agree, — said Yuri Pavlovich.

The rest was a matter of technique. Per himself took on the protocol. We understood that our version was one thing, but if the

capitalists wrote it, it was another. They understood all the subtleties of international laws well. The text was written in English. Irina translated it aloud. Yu. P. Semenov signed first. R. Grant watched him intently, and after Yu. P. Semenov's signature, his last hope faded. E. Tenset also signed. It was R. Grant's turn. After carefully reading the protocol once more, he took out his "Parker" and, as if signing his own sentence, affixed his signature. Champagne, small pieces of cake, and cookies appeared on the table. As the Norwegians explained to us, champagne is only drunk in the West for solemn occasions. They regarded this event as particularly important. R. Grant also raised his glass, but judging by his expression, it was impossible to say that he shared the same opinion about this event.

We later understood what this signature cost Boeing. The oldest aviation company in America, which had conquered 80% of the world market for civil aircraft, could not afford to put even the slightest stain on the company's image. If its employee had signed, disavowing such actions was not in Boeing's rules. They feared a new scandal that might erupt because of this. Boeing could now only hope that the project would not be economically viable. And it could no longer withdraw the signature. This meant that a third partner, Kvaerner, had unequivocally appeared in the project. But this was only if the project proved profitable.

We drove to the airfield. It was late evening, and it was snowing lightly. The crew, led by A. N. Tinkov and V. I. Pyatkin, reported that everything was in order. The plane was ready for flight. Through the porthole, we saw the Norwegians with R. Grant walking towards their "Gulfstream." They were given clearance to depart first. We took off after them. The table was set quickly. We poured a toast to the success of our trip. The General was very pleased. He never tired of admiring the platform.

— And what do you envision as the technical vessel? After all, it must allow for the assembly of the rocket and block, — he asked me.

— The Norwegians mentioned some "Ro-Ro" vessel. They say there are such vessels that transport up to three thousand cars. It could be reconstructed. But what it would cost is hard to say.

— We need to decide faster.

Time flew by quickly. We were back at Vnukovo-1. Customs, passport control, and — into the cars.

It felt like I had been abroad, and yet not. But there was a stamp in my passport indicating I had visited Finland.

I arrived home. The guests had not yet left. The thing is, November 25 is my wife's birthday. On this day, our friends don't

wait for an invitation; they simply come to congratulate Lena. We are willy-nilly forced to prepare for the gathering. So, as they say, I went straight from the ship to the ball.

FIRST CONTOURS

From this day, time flew by rapidly. The General pressed every day. Work needed to be accelerated. The work needed to acquire a definite organizational framework. After all, we had to involve our co-contractors, which meant a coordinating body was needed. In our engineering, traditionally since S. P. Korolev's time, this was the Council of Chief Designers. It needed to be specially created for this topic.

And not only a council, but it was also necessary to create an operational and technical management (OTM) for the daily resolution of current issues, both technical and organizational. I proposed members for the Council to Yu. P. Semenov. He was the chairman, and the chief designers of other co-contractor enterprises became members. He also approved the composition of the OTM for this topic. I was entrusted with leading the OTM. The General Designer S. N. Konyukhov from KB "Yuzhnoye" joined the Council of Chief Designers. Yu. P. Semenov spoke with him; there seemed to be no refusals to work on the Council, but no activity either. S. N. Konyukhov appointed V. G. Gudim to the OTM.

The first Council meeting on this topic needed to be prepared. It took place a month after our trip to Turku. On the General's behalf, I briefly reported on the essence of the project. It was met with general approval; the Council and OTM were approved.

Now, regular OTM meetings on the topic needed to be held. I convened the first meeting at the end of the year. It started at 3 PM and ended around 9 PM. I let everyone express how they saw themselves in the project and what they would prefer to do.

The socialist sentiment, such as: "You tell me what I should do, and I'll prove why I can't," — had not yet completely vanished from many minds, but those who understood that they needed to quickly seize the work began to demonstrate their advantages. We listened to the cryogenics specialists from Balashikha. They perfectly understood what to do but set high prices. Representatives of "Uralkriogenmash" offered their services at lower prices. It was necessary to decide how to build this connection. KB "Armatura" from Kovrov, represented by its head Yu. L. Arzumanov, was ready to do all the automation and develop the gas supply for the complex. KBTkHM, led by M. I. Stepanov, was ready to develop the fueling systems for the upper stage. The Rostov residents were ready to develop the control panels, and our 6th complex undertook to link the fueling control system for both the rocket and the upper

stage. Representatives of KB “Yuzhnoye” did not come. Apparently, they had their own considerations.

The speech by the deputy chief designer from the Design Bureau of Transport Engineering (KBTM), V. G. Makarychev, was a complete dissonance. By the time his turn came, the General appeared in the office. He greeted everyone and sat down nearby.

“I won’t interfere, I’ll just listen,” he said quietly.

V. G. Makarychev went to the board and began to explain that they had worked on such a project, that no one else understood anything in this project except them, that they had estimated the cost of such a project, that only KBTM could be the lead enterprise for creating launch facilities for “Zenit,” and as for the upper stage, that was “a piece of cake” for them. The cost of work just for creating the launch systems, without technical preparatory work, according to his estimate, was approximately 350-400 million dollars.

“Who is this oddball?” Yu. P. Semenov quietly asked me.

“This is G. P. Biryukov’s deputy from KBTM.”

“Don’t let him into the OTM again. He’ll stir everyone up. Our organization for launch systems has always relied on a traditional co-contractor — the Design Bureau of General Machine Building.”

Even under S. P. Korolev, their head, V. P. Barmin, was part of the famous “six” group of the Council of Chief Designers. This is the organization that developed the launch facilities for the first ballistic missiles, for the “Soyuz” rocket, or as we called it, the “seven,” for the reusable “Energia-Buran” system. But here was a different rocket. A rocket from Dnepropetrovsk, and their traditional co-contractor for ground systems was V. N. Solovyov’s firm — KBTM.

Changing co-contractors in such a large project was not convenient for us, and also incorrect. So we had to get acquainted with this firm. V. G. Makarychev’s speech was the first attempt.

The first decision of the OTM was a request for everyone to once again review and weigh their capabilities for executing such a project. Everyone listened to each other, and now the understanding of the project was broader. The only thing I constantly reminded them of was that the project was commercial, so delays in work completion were excluded. And the price had to be minimal. I asked for preliminary work schedules from everyone to assess the project implementation timelines. With that, we adjourned.

The year 1994 was approaching. The Norwegians sharply intensified their work. It seemed to us that the role of the semi-submersible platform was predetermined; all that remained was to

choose a vessel for managing rocket preparation for launch. But the Norwegians did not think so.

Constant calls to us and inquiries about the requirements from the missile systems spoke of their concern for the fate of the platform, and thus their participation. They understood that if Boeing chose the concept of a sea launch from a huge tanker with us, there would be no place for them in the project. Therefore, they threw all their efforts into conducting comparative evaluations of these two concepts.

The Norwegians were not mistaken in their assumptions. We received a fax from Boeing literally at the beginning of the year, where it advocated for the tanker. Per H. Kristensen asked us to fly to Oslo. V. N. Bodunkov and I flew to Norway on January 4th. Kvaerner covered all expenses. Per H. Kristensen and Irina met us at the airport.

NORWAY

My first impression of Norway was strong. I remembered how one of our department heads, who had been on a business trip to Norway around 1977, expressed his impression:

— Do you know that we are building communism? That's communism there. Everything is there.

We were immediately taken to lunch at a small restaurant at the airport. We trusted Per. He ordered many appetizers and baked salmon. I had not tried such a dish before. But the salmon was simply wonderful. Tender, moderately fatty, lightly salted, it simply melted in my mouth. Lunch passed without alcohol. As it turned out later, Norwegians, unlike Russians, do not indulge in alcohol, and its prices in Norway are quite impressive: 50 dollars for half a liter of vodka speaks for itself. We therefore always brought our Russian souvenir with us in the form of two bottles of vodka. Then we went to the five-star SAS hotel. After leaving our belongings at the hotel, we went to one of the Kvaerner companies — Kvaerner Moss Technology. I hoped to see a design building, as is customary with us. But I saw that in the three-story building, in addition to Kvaerner, there was another company. And Kvaerner occupied only half of the second floor.

In total, about twenty people worked at the company. Each had their own room, equipped with a computer, telephone, and office supplies. Nothing superfluous, a separate meeting room and a common hall with plotters, laser printers, copying equipment, and necessary consumables. An engineer at his workplace drew a drawing on the computer and uploaded it to the network. If a plotter was free, it immediately began to draw everything the engineer had specified on paper. The same was true for printed text. Considering that all Kvaerner factories were covered by the network, it was easy to imagine how quickly documentation reached the executor, and how simple it was to correct a drawing if necessary.

In our, by our standards, leading company, such technology was only being introduced.

At Kvaerner Moss Technology, Per introduced us as honored guests. He gave us a considerable daily allowance. Every evening — dinners in expensive restaurants and discussions about the need for a platform in the project.

I had no questions about this. But Per invited Norwegian Veritas, which performed calculations on the survivability of the

platform and the tanker and showed that if an accident occurred on the tanker, it would sink. He hired an experienced deep-sea captain who analyzed all American ports where supertankers could enter. It turned out that there were only three in the world. Having received materials on missiles from us, his engineer now began to draw the installation of missile equipment on the platform. It was necessary to understand if the platform's carrying capacity would be sufficient. Fortunately for us, Poryadin G. A. flew to Oslo the next day. We spent two sleepless nights with him at the hotel, wanting to understand how capitalists think, what Per H. Kristensen and the Kvaerner company represent, and how to interact with Boeing. The conversation was long.

The strategy was developed as follows:

— Here, — Poryadin G. A. reasoned, — first you must firmly embrace Kvaerner, otherwise Boeing will devour you. Boeing will structure official documents and write agreements in such a way that your interests will be left far behind. They only love themselves. They will involve lawyers, hire consultants, so that there is not the slightest loophole for infringing on their profits and prestige. The Norwegians will fight for themselves, but, under the guise of NPO Energia, they will try to enter the project without losing their share. They will help you draw up the documents correctly. Then Kvaerner will embrace Boeing and try to squeeze you financially. Be careful here. I advise you to hire international lawyers.

— Or maybe we will have to withdraw from the project. We will get the money now, work for a while, and then — goodbye!

— I do not advise doing that. We are entering the international market. They — both Norwegians and Americans — will burden you with such obligations that you will have no escape. Otherwise, NPO Energia's image on the world stage will fall so low that all your international contracts will burst. By the way, does NPO have any?

— Yes, for manned topics. You know that the state has practically abandoned us. We only live by this today. We are paid for international launches.

— You see, all this will end in one minute. So think carefully. Do you know how they fight for a company's image in the West? It's everything to them: both work and advertising.

Yes, we are indeed entering the market, not understanding much. I asked how best to understand these relationships? We are very interested in this project, but we don't want it to be unprofitable for us.

— This cannot be allowed, that's right. That's why I advise

hiring lawyers.

— And what kind of person is Per H. Kristensen? He seems simple and charming to me.

— It's good that he seems that way. But in fact, he is very cunning and smart. He will write the documents himself. You'll see, he sees far ahead. He has a good legal education.

— Of course, with this project, Norway will become a space power, which means Per H. Kristensen's prestige will greatly increase.

— He doesn't care about being a space power. He's only interested in money for Kvaerner, for himself. I'll tell you more about him sometime. Let's sleep, it's already 4 o'clock.

We went to our rooms. I couldn't sleep. I tried to make sense of everything I had heard.

In the morning, back to the office. Again, small lectures on rocket technology. The engineers listened with interest when the preparation of the rocket for launch was discussed. Further interest waned, as the flight interested them significantly less. They had already begun to link the rocket equipment to the platform. These were the very first estimates. They were carried out mainly to understand: is the platform suitable? So far, they had not criticized our requirements, but the questions were becoming more specific.

In Oslo, the post-holiday sale had begun. Stores were simply overflowing with goods, people had not yet recovered from the holidays. We were surprised by the store hours: from 10 am to 5 pm. It seemed, why were these hours chosen? Everyone works, who will buy? We were explained that, mainly, all purchases are made on Saturday. After all, it's very simple, you come and buy, and if something is not available, leave an order, and they will deliver everything you want to your home at a convenient time. And no queues. At that time, this was unusual for us. After all, with us, everything had to be obtained or stood in queues for.

Per H. Kristensen literally did not leave our side for a moment. He participated in all technical discussions. It seemed to me that the gambler in him had awakened again.

In the evening, he invited us to one of the most expensive and prestigious restaurants. It was located in the center of Oslo and was called "At D'Artagnan". We drove up to the restaurant in a luxurious American car. Per explained that there were only two of them in Oslo. One belonged to him — a five-seater Chevrolet. We left the car on the second floor of a three-story underground parking lot. We approached the restaurant. V. N. Bodunkov nudged me and pointed with his eyes to the display window of one of the stores. I didn't understand.

— Look closely.

My nearsightedness still didn't allow me to make out the display window when, after a doorbell ring, a voice from the speaker said:

— Please introduce yourselves.

— Kristensen.

— Come in.

The door opened, and we found ourselves in a small hall where there were three low coffee tables and soft armchairs nearby.

— What a restaurant, — I thought, — and what's prestigious about it?

— Make yourselves comfortable, — Per invited us to the armchairs, "an aperitif will be offered to you now. What would everyone like?"

Vyacheslav Nikolaevich Bodunkov reacted immediately.

— Gin and tonic for me.

— Just water for me, — I told Per. At that time, something was wrong with my health, and I was very wary of alcohol.

Someone ordered white wine, someone beer. The waiter brought a huge tray on which five tiny pastries were arranged.

— This is a gift from the chef, — Per explained.

About fifteen minutes passed. The waiter approached us again. He had a solemn and serious look. He wore a white apron, and a snow-white, tall chef's hat adorned his head. Inviting us with his hands, he began to back away and then ascended the stairs to the second floor in the same backward manner. Noticing the surprise on our faces, Per smiled, as if saying, "Look at us."

On the second floor, there was a dimly lit hall with large tables where candles burned. One of the tables was reserved for us. In front of each person were three incredibly clean glasses, a huge plate, and shining silver cutlery. Per, like a true gentleman, handed the menu to Irina, who began to tell us what was available.

— Our dinner will consist of eight courses, — Per said, — I don't think you'll have to go to McDonald's after this, — he joked.

We placed our order. On Per's advice, we ordered "saddle of lamb" for the main course, and salmon, vegetables, and shrimp for appetizers. Before the main course, everyone was given a slice of watermelon to refresh their palate and appreciate the taste of the meat. There was a whole procedure for choosing the wine. Per ordered white Californian wine, and red for the main course. The waiter brought the bottle and opened it right in front of us. He poured a little into Per's glass. Per, like a true wine connoisseur, swirled the wine around the edges of the glass for a long time, sniffed it, then tasted it, and nodded his head with satisfaction. This

was a sign that the wine was good and could be poured for the guests. Wrapping the bottle in a starched napkin, the waiter poured the wine into the glasses.

All the dishes were brought on huge plates, but the portions could fit on coffee saucers.

There was a whole ceremony for serving the main course. On an elegant trolley, dishes with our hot meal, covered with huge metal cloches, were wheeled in. They were placed in front of each of us. Two more waiters approached, and on command, they simultaneously uncovered our plates. Wishing us a pleasant meal, they withdrew, leaving in front of each of us five small pieces of meat, garnished with asparagus and a small amount of potatoes. The trolley rolled up again. We were offered cheeses; we could try about ten different varieties of cheese. All of this was presented kindly, with a smile. Then another trolley — with ice cream, also several varieties and various jams. Then fruits. The entire dinner lasted several hours. Afterwards, there were visits to other restaurants, but this first, expensive one, remained memorable for a long time.

The conversations at the table were, as they say, about nothing. But Per asked very specific questions. We understood that a process of mutual study was underway. The bill was presented. Per studied it carefully, wrote something in it, took out his credit card, and handed it to the waiter. The waiter returned a few minutes later and thanked us for our visit; the bill was put away in his wallet. We walked to the car. On the way, I asked Georgy Alexandrovich Poryadin:

— How much did this dinner cost?

— I think about eight hundred dollars.

— Wow.

— Per doesn't throw money away. That means he has serious intentions. And besides, he's not paying with his own cash. He'll submit a report, and the company will pay.

— I have a suggestion, — Per said, approaching us, — tomorrow is Saturday. You can wander around the city, and on Sunday we'll go skiing. How about it, is that acceptable?

— But for that, we need equipment, gear.

— We'll sort that out tomorrow.

In the morning, we went to the huge "Oslo City" store, where we bought everything we needed. Indeed, there were no problems.

— We'll get skis and boots on site, — said Per.

The next day, we drove out of town in two cars to the ski slope. The mountain road was amazingly beautiful. I especially remembered the road along the mountain lake. In the second car

were Sasha Areshev with his family, V. N. Bodunkov, and G. A. Poryadin. Sasha worked at Kvaerner under contract and quite often acted as an interpreter in Irina's absence. He had been in Norway for two years. A charming guy, always ready to help us with advice and, if necessary, a trip to the store. We visited his home. We saw his dwelling. Irina, his wife, was incredibly happy about our arrival. Their children attended a local school, and from their conversations, it was clear that they liked it very much there.

Sasha was from the south, from Armenia; he had never skied, not even on regular skis.

Here is the base. We quickly rented skis. And — to the lift. The beauty was extraordinary, as they say, breathtaking. Ski slopes were clearly visible in the mountain forests. From the top, they fanned out. The shortest was the steepest, and further on — more gentle, but longer.

Of course, we chose the longest one. I had never been on downhill skis before, but I slowly got the hang of it and started my descent. The feeling of speed, the whiteness of the snow, the beauty of the snow-covered trees flashing by, brought an incomparable sensation, like the flight of a bird or driving a sports car. Only the pushes of my feet made me realize that, besides enjoyment, I also needed to keep an eye on the track, otherwise I would tumble down, outrunning my own skis. I safely reached the bottom. I got back on the chairlift and went up. Only on the third time, when I had descended a third of the way down the track, did I see Sasha Areshev standing. Covered in snow, he was putting on his skis again.

I stopped:

— How many times have you been down?

He looked at me very sadly:

— Is it still far to the bottom?

— About two-thirds.

His appearance became even more pathetic. I realized that this was his first, and perhaps his last, descent.

On the way to Oslo, we stopped for lunch at a small restaurant. We returned late. The evening, or rather night, road was illuminated, and therefore everything looked more mysterious and enigmatic.

I will long remember this trip and my first visit to Norway in general. I especially liked the spirit of patriotism that I observed in almost everyone I met. I first felt this patriotism in America, where everything was so frank, so demonstrative, but here it was unobtrusive, yet everything was presented with dignity. On one of the trips, I remember, we visited the Maritime Museum, where both

the “Kon-Tiki” and the “Ra” are carefully preserved. Pride in the fortitude, in the courage of the Norwegians. Love for their history literally shone from all the stained glass and exhibits. And how everything is designed!

I involuntarily recalled our NPO Energia museum, where we have such exhibits that one could talk about for hours. And everything is crammed into a small hall: the model of the first satellite, Gagarin’s Vostok spacecraft, the Salyut station, the satellite with the dog Laika, Martian probes, and probes that flew to Venus. Well, we certainly have something to be proud of!

When you see that the Exhibition of Achievements of National Economy has been turned into a large bazaar, when the “Cosmos” pavilion has been, figuratively speaking, turned into a “stable,” it becomes so offensive for all of us, for our lack of principles, our sloppiness, that sometimes it becomes uncomfortable to look our partners in the eye. “It’s a shame for the country.”

Let’s return to our narrative about “Sea Launch.” Having made a small digression about Norway, I, of course, wanted to at least briefly show the reader the environment in which the project originated. The Norwegians worked at full strength. Boeing began to falter. It was obsessed with the idea of a tanker, and it was not difficult for me to understand why we received faxes as if there was no platform.

One day — a call from the General Director:

— Do you know that R. Grant was sent into retirement?

— Wow! — was all I said.

I remembered R. Grant before signing the protocol in Turku. No wonder he looked that way; he probably had a premonition.

R. Grant was not forgiven for signing the protocol. Boeing could not disavow his signature, but it also could not accept that R. Grant had allowed Norway into the project. Nor could it withdraw from the project without serious grounds.

Having returned from America once, the General Director said that he had met with R. Grant, and the latter told him:

— You know, Yura, they are to blame for my retirement, — and he pointed with his eyes at the Norwegians.

We acknowledged the protocol that Per H. Kristensen wrote in Turku. We understood that we were now bound by certain obligations, and since we really wanted the project to go forward, we were glad that everything fell into place. Now it was time to work. The Norwegians were somehow nervous. They understood that Boeing would make more than one attempt to push Norway out of the project.

Soon I received a fax from V. Callori. He suggested meeting in

Oslo to discuss some project details.

This time I flew to Oslo alone. Again, the SAS hotel. Vincent arrived with his wife. As always, he combined the business part of the trip with tourism.

For a long time, the three of us: I, Per, and Vincent, discussed the concept of building “Sea Launch.” Tedious and lengthy comparisons of the platform and the mythical tanker began. Per believed that this was the decisive round.

The limited number of ports the tanker could enter, its survivability, rolling from transverse waves, maintaining course, crew safety — all of this argued against the tanker. And where was this tanker anyway? We had walked on the platform, but the tanker?

When, finally, all arguments had been considered, Per suggested writing a meeting protocol. Its essence was as follows: based on the materials reviewed today, preference should be given to the platform, and further developments would show.

Vincent’s technical arguments ran out, and then he declared:

— I cannot sign such a protocol. I do not have permission from the United States government.

— ?!

I had heard before about this permit, which is called TAA — Technical Assistance Agreement. Indeed, in the USA, without such a document and its approval at the government level, there was a ban on joint work with foreign partners. Later we formalized such a document, but now Vincent’s statement put me in a difficult position. Per was silent, he lowered his eyes, understanding that Vincent was right.

Thoughts raced through my head like wild horses. Had we really lost the project?! I associated it with the platform and Norway. Again, the thought that if we were left alone with Boeing, nothing good would come of it.

— Listen, Vincent, is it that you cannot sign such a document as a protocol with Russia, but you could sign it with your NATO partners?

— We could. It’s much simpler.

— Then I have a proposal. Sign the protocol for two — you and Norway. Two NATO countries, and I, as a representative of Russia, will wait. But let’s somehow conclude our meeting.

Per livened up, his eyes lit up, he looked at Vincent and smiled his unique smile, which contained both benevolence and superiority.

Vincent froze. He changed literally before my eyes. His face turned gray, his eyes showed horror, hatred, a plea for help,

hopelessness. He looked at me, probably cursing inwardly, for a long, long time. He realized he was caught. I also looked at him. Inside, compassion for this man was born. A man I respected for his good engineering logic, a man who created the Saturn rocket, a man who was the first to agree to the project. Would he suffer the same fate as R. Grant? — flashed through my mind.

The silence dragged on. Vincent turned to the window and looked for a long time, as if weighing everything that had happened. Finally, he said:

— Slava, I will sign the protocol.

My respect for him increased by an order of magnitude. He was a man of technology and remained so. He put political nuances aside.

— Thank you, — I only managed to utter.

— Good, — said Per, — I will now revise the protocol. I will leave two signatures.

— No need to revise, — Vincent said, — let Slava sign it too. — He had already decided something for himself and now, having taken one step forward, he did not stop.

I was going home with mixed feelings. First, that the trip seemed to have ended successfully, the General Director should be pleased. But the second feeling tormented me. I had caused trouble for someone. That was not in my nature.

Per drove me to the airport. He said:

— We have taken another step forward. If the platform is in the project, I think you will be driving the same kind of car.

I didn't understand what he was hinting at.

— You can't drive such a car in Russia. They'll stop you, throw you out of the car, and drive off in it.

— Well, then, another one from which they won't throw you out.

I could only guess what Per was hinting at. With such a proposal, he wanted to draw me even deeper into the web of his ideas. Later, I became convinced of the worth of his promises.

I reported on the trip to the General Director. A week later, a message arrived that V. Callori had been removed from his position. Boeing is Boeing. If you don't complete the task, you're out. Harsh laws.

We had to move on. After all, having bet on "Zenit," we also needed NPO Yuzhnoye as a partner, although it had split into two enterprises: the Yuzhmash plant and the Yuzhnoye Design Bureau. Yuri Pavlovich had already spoken on the phone several times with the plant director Yuri Sergeevich Alekseev and General Designer Stanislav Nikolaevich Konyukhov. They seemed not to object to

such a turn of events, but independently of us, they traveled around the world, offering services for launching satellites on “Zenit.” And then there was the exclusive right to launch “Zenits” given to a small American company. True, this was done through the Enernm company, but the right was given.

Undoubtedly, without NPO Yuzhnoye, discussing the Sea Launch program would have been incorrect, and the project could have fallen apart altogether. I was simply amazed by the patience of our General Director when issues of Dnepropetrovsk’s entry into this project were being resolved.

In the old, as we used to say, good times, it was customary for the Design Bureau to receive the order for the complex, and all subcontractors “followed” it. Therefore, all responsibility and power passed to the General Designer. But here there were two General Designers, and who was subordinate to whom? It must be said to the credit of our General Designer’s wisdom that he was the first to overcome this hegemony. Probably, having visited foreign countries more than once, he drew certain conclusions for himself, and now his goal was not to perpetuate his dignity, but rather to fight for work, for jobs, for finances. No one, of course, is immune to selfish feelings; perhaps the laurels of his predecessors also somehow influenced his consciousness, perhaps the spirit of our Design Bureau also played its part, but the “Sea Launch” theme was avant-garde, new, and extraordinarily difficult both technically and organizationally. Probably, S. P. Korolev had an even harder time when the first satellite was launched. Then Yu. A. Gagarin, when the first ships went to the Moon, Mars, Venus; it was not easy for V. P. Mishin during the work on the lunar expedition and the creation of the new manned Soyuz spacecraft; it was not easy for V. P. Glushko either, when the reusable Energia-Buran system and the most powerful engines in the world were created. But in those days, these were state tasks, there was the Politburo, the Central Committee of the party, the Military-Industrial Commission — all these bodies not only set the task, not only controlled, but also helped, and how!

But here was something completely new in its organizational essence: a purely commercial project. Practically without the participation of state bodies. After all, after the collapse of the Union, the newly formed agencies and ministries had not yet started working at full capacity. On the one hand, it was good that there was no need to overcome numerous formalities, but on the other hand, no help was expected from them. Things were not going well in Ukraine either.

The rounds of office visits began. We understood that without a

government order, without obtaining licenses (they were just being introduced then), we would suffer later. Thanks to his long-time acquaintance V. A. Pivnyuk, our General Director secured an order from V. S. Chernomyrdin — the Prime Minister of Russia — allowing NPO Energia to participate in the project and coordinate all Russian enterprises and communication with Ukraine.

But the activities of our Ukrainian colleagues were not entirely clear to us. They continued their independent policy, as if nothing had happened. They sought orders for “Zenit.” We received several faxes from KSMK — a small firm from Denver — where they informed us about the activities of the Yuzhnoye Design Bureau, which were in violation of its obligations to KSMK. Yu. P. Semenov repeatedly suggested acting jointly, not scattering efforts, but on the contrary, uniting, because individually we would simply be torn apart. Ukraine agreed, but did not cease its activities. All arguments that “Zenit” was 60-70% manufactured in Russia were met with incomprehension.

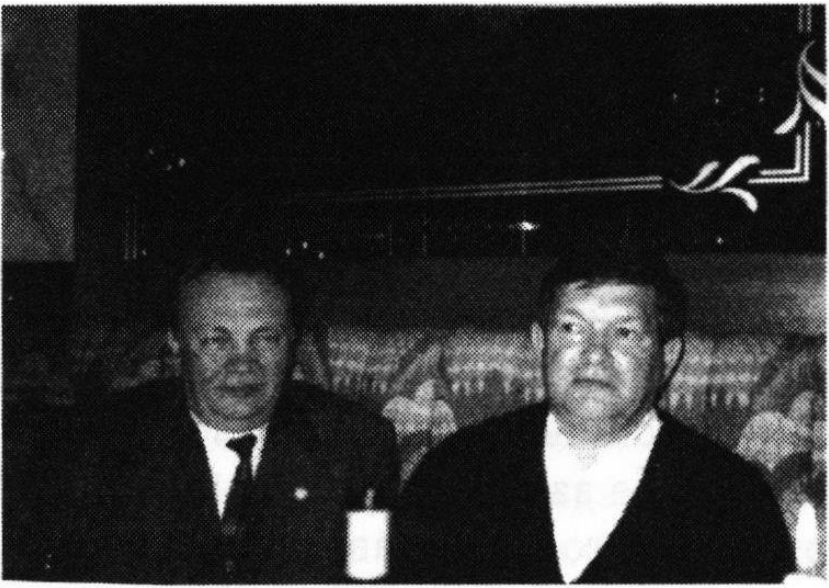
In March, the technical proposals were made.

The preliminary design for “Sea Launch” turned out to be quite substantial. 23 books were published, in which the technical characteristics, the structure of the means, and the requirements for these means were defined, i.e., the project’s appearance was completed.

The project was sent to Kvaerner and Boeing. By the way, the volumes were published in both Russian and English. After some time, Kvaerner asked us to come to Oslo; they wanted to discuss our preliminary design. They also invited Boeing. We did not object. We went to Oslo with V. V. Liberman and A. N. Shorin. We understood that the normal creation process had begun.

Organizational changes occurred at Boeing. Patrick

S. Inyart was now appointed commercial director of the project, and Horder L. Livingston was the project lead. Horder L. Livingston and several other engineers arrived in Oslo.



Together with Patrick S. Inyart

A DIFFICULT TIME

The conversation in Oslo with the Americans didn't go well. Judging by their questions, they hadn't even looked at our "blue" books (the volumes of the preliminary design). Horder L. Livingston pretended that there was no platform, only a tanker, and steered all discussions towards that. This greatly irritated the Norwegians. Experienced long-haul captains were invited, who tried to convince Boeing that the platform was the most optimal for the purposes of "Sea Launch," and that we simply wouldn't find ports for supertankers to call at, but all arguments literally crumbled, encountering the indifference of the Americans. They behaved quite brazenly and, as if predetermining events, didn't want to hear anything. Per and I patiently explained the advantages of the platform, but we couldn't get an affirmative decision. We decided to go home. The Americans took our materials and promised to think about it further.

The outlines of the project were already quite clear. The time was coming when the help of Yuzhnoye Design Bureau was needed. After all, the Zenit rocket was designated as the main launch vehicle for "Sea Launch." The General Director had spoken with S. N. Konyukhov many times. It seemed that everything was fine, there were assurances to work together, amicably. There was an understanding that separately we would be crushed. Boeing and Kvaerner supported Yu. P. Semenov's proposal that NPO Yuzhnoye should become a partner in our Company. Such a joint meeting needed to be organized. Our General Director took this upon himself.

We gathered in Moscow. We introduced Yu. S. Alekseev — Director of Yuzhmash, and S. N. Konyukhov to the partners. As they say, we signed off on friendliness and assurances of cooperation. We agreed on further meetings.

S. N. Konyukhov said that his Design Bureau had been looking for work for the Zenit rocket for several years, that they had already gone far with the Loral company regarding the use of the rocket for three launches of their satellites, and that he could not abandon such work. The partners agreed with him, but the request was not to go further, but to give the exclusive rights for the rocket to the new Company. This did not suit the southerners at all.

Moreover, one of S. N. Konyukhov's deputies unexpectedly began to support the project using a tanker. This encouraged the Americans, who started playing directly with the Yuzhnoye Design

Bureau. Everything returned to the starting point. Now the Norwegians and I had to fight with the southerners as well. Again, tedious negotiations, proofs, arguments, quarrels. And then V. G. Komanov, the chief designer of Zenit, also got involved in the project. With socialist conviction, he began to argue that the Yuzhnoye Design Bureau should be at the head of the project, and everyone else under it. Apparently, he forgot that Ukraine and Russia had become independent states, that there was no longer a Central Committee or a Military-Industrial Commission, and that a different form of interaction in the form of a partner Company was needed. But one still had to come to this both mentally and practically. I held more than one meeting with V. G. Komanov to reach a certain agreement.

And it got to the point where the Yuzhnoye Design Bureau gathered a Council of Chief Designers on its territory, where, in addition to technical issues, it was proposed to discuss organizational issues related to project management.

— You go, listen. Try to constructively discuss technical issues, don't get bogged down in trifles. This project is beneficial for us and for the Yuzhnoye Design Bureau. It's about loading the Zenit,— the General Director instructed me.

— And if organizational issues are discussed? Who is in charge and so on?

— Do not participate in them. Stay away from them. They will be resolved later. I think reason will prevail.

With such instructions, our delegation went to Dnepropetrovsk.



At Yuzhnoye Design Bureau. In the foreground, Yu. P. Semenov

and S. N. Konyukhov

Indeed, all the main co-contractors for the development of the Zenit rocket came to the Council of Chiefs: NPO AP, KBTM, NPO Energomash, and others. The agenda was read out. The first questions were purely technical, the last — organizational. I asked to remove it.

— We will not remove it, we put it there for informational purposes. We suggest you listen.

— What does it mean to listen? To listen and not respond means to agree. To respond means to discuss. I have not been given such authority.

— But we will still listen, — concluded S. N. Konyukhov.

The first questions of the Council were devoted to the modifications of the rocket

for the project. Firstly, the rocket was becoming three-stage, which meant that the load on it increased, and it needed to be strengthened. It was necessary to be able to refuel the third stage, whose role was performed by our DM upper stage, vertically at launch — through the rocket's communications. Another modification!

And one of the main questions: a single or separate control system? Our organization and NPO AP insisted on a separate system, one for the rocket, the other for the upper stage. This allowed for both two-stage and three-stage rockets. True, we agreed on the postulate that the base for the control system would be unified, built on an identical computing complex. This was accepted.

We proceeded to the last question. I again asked to remove it. They didn't remove it. Our delegation stood up and left the meeting room.

After the Council, I approached S. N. Konyukhov:

— Stanislav Nikolaevich, I earnestly ask you to meet, sit down with Yuri Pavlovich, and agree on how to build the bridge — lengthwise or crosswise. We will never agree on this at our level.

— Alright! We will definitely do that. But you and V. G. Komanov, don't get all worked up, but try to develop proposals on how we should work and propose a joint document.

— Not against, but only for. We need to proceed from achieving the ultimate goals.

— So proceed from whatever you want, and prepare the document.

— Alright.

— I will be in Moscow soon and would like to sign such a document.

And so we parted.

The “Sea Launch” project, in its organizational essence, began to acquire the theme of “Energiya-Buran.” Only there, everyone was their own, and here — foreign colleagues. Such cooperation of huge firms from different countries required special government decisions. The Americans needed to obtain permission for technical assistance, we needed to obtain a license and government order for conducting such work. Ukraine needed permission from the national space agency and the President’s “go-ahead” for participation in the project and the transfer of exclusive rights to the Company. But the main thing was to decide among ourselves — in the CIS: who does what and who is responsible for what.

In February 1994, we managed to gather the main contractors in Moscow, on our territory, sit everyone down together, and agree on cooperation.

NPO Energiya was designated as the lead developer of the space rocket complex and the developer of its space head section.

Yuzhnoye Design Bureau — lead developer of the space launch vehicle as part of the complex.

NPO Automatics and Instrument Engineering — lead developer of the rocket and upper stage control system.

KB Transport Machine-Building — lead developer of the launch device, mechanical docking, and installation equipment.

NPO Energomash — developer of the main engines for the first and second stages of the Zenit launch vehicle.

Instructions were given for the development of a detailed distribution of work with all co-executors, and its draft was to be prepared by April.

This document was signed by Yu. P. Semenov, S. N. Konyukhov, Yu. S. Alekseev, V. L. Lapygin, G. P. Biryukov, and A. V. Safonov. The document was born in heated arguments. It is worth noting the role played by Yu. S. Alekseev — director of the Yuzhny Machine-Building Plant. His gentle approach and personal charm, his ability to smooth over sharp edges, to make a joke at the right time, to see the main point in resolving an issue — became some of the reasons for signing the document.

Our General Director, encountering resistance from the Zenit developers, often asked Yu. S. Alekseev for help. Yuri Sergeevich saw the main thing, that this project meant work for the plant, and that meant jobs, salaries, and the preservation of advanced technology. That is why he ignored theoretical disputes and asked to solve the main problem first, and then the question of greatness. This greatly pleased my General Director, who saw the entire project as a whole and sometimes did not understand the

bargaining that the Yuzhnoye Design Bureau proposed. It was in such agony that this document was born. It was agreed that this distribution, at the suggestion of the Yuzhnoye Design Bureau, was only for the stage of technical proposals.

— And then we'll see how events unfold, — S. N. Konyukhov summarized.

Pleased that we had found, as it became fashionable to say, a consensus, we went to lunch. Over lunch, the conversations were only about joint and friendly work.

— Only together, — our General Directors concluded an unspoken agreement.

The main organizational issues did not prevent the engineers from developing the project. It was necessary to define the tactical and technical specifications for the complex, to break down its structure into squares to determine the role of each component of the project, its purpose, and its relationship with other elements of the complex.

A technological work plan was needed to show the work of all parts of the complex, the executors of the work, and the necessary documentation within a time cycle.

A general work schedule was developed, and the duration of the main stages of creating the complex was determined.

A business plan was a new document for us. Our design bureau, and others, did not produce such a document during the Soviet era. We knew the technology, and the order, as a rule, was governmental. We were told: it's needed — we executed. The transition to market relations required an assessment of economic feasibility, an assessment of payback, and an assessment of profit from the project. We, as we understood (and we still didn't understand much about these issues), wrote a draft of such a document. Later, when Boeing presented the business plan for the complex, we realized our naivety. True, the process of learning market economics proceeded quite quickly. Sufficient engineering and economic training allowed our economic services to quickly grasp these issues.



Yuri Sergeevich Alekseev

The system for creating any project required defining the work of each co-contractor, for which they needed to be issued technical specifications for the work. At the first stage, all were issued technical specifications for the development of technical proposals.

During this period, specifically in the first quarter, many general issues concerning the complex had to be resolved, on which the feasibility of the project depended. This primarily involved

determining the launch dynamics, the loads on the Zenit launch vehicle and the rocket's impact on the launch platform, outlining solutions to economic and safety problems, defining the logic of the control and targeting systems, choosing flight trajectories and the launch site, settling on communication channels between vessels, and estimating personnel numbers. In total, 23 meetings of the operational technical management were held during this time, at which the main fundamental decisions were collegially discussed and adopted.

In early March 1994, another meeting of partners took place at NPO Energia. Boeing was represented by Patrick S. Inyart, Kvaerner by Per H. Kristensen, and NPO Energia and Yuzhnoye Design Bureau (by power of attorney dated March 7, 1994) by Yuri Pavlovich Semenov. Further study of issues concerning the creation of a joint Company was underway. The main condition put forward by the foreign partners was the provision of exclusive rights to use the Zenit, Zenit-3 launch vehicles and their modifications, which would be considered a reliable contribution of NPO Energia and Yuzhnoye Design Bureau to the Company.

We understood our partners. The political instability in our countries at that time made them very wary. The project, they believed, carried a high political risk. Therefore, without strict obligations from Russia and Ukraine, they could not proceed with it.

At this meeting, it was agreed that the agreement signed in Turku would be suspended for a whole month until Energia and Yuzhnoye provided an answer on this matter.

In the event of a positive response, the parties determined that a meeting in Oslo would take place in April to discuss technical issues, and the group would work for the period necessary to develop a mutually agreed budget concept.

Boeing will present a draft Technical Cooperation Agreement, but warned that without a decision on exclusivity, it cannot present it to its government.

The question of exclusivity was not new to us. We had met several times with American firms that offered their cooperation and money in exchange for exclusivity. For example, in June we signed an agreement with CSMK that it would market the Zenit launch vehicle in the American market, and we promised it exclusivity. However, this firm did not fulfill its obligations, including financial ones, and by September all business contacts with it began to fade. We repeatedly warned CSMK about non-fulfillment of obligations, and then sent them, as the agreement required, an official notice of its termination. Then, four years later,

when the project was in full swing, a new owner sued us, claiming that we had not allowed him to develop and had caused him enormous damage. This seemed naive and foolish to us. But legal cases in America are conducted on a grand scale. It is not for nothing that Americans say that their richest people are lawyers and doctors. Lawsuits can last for months, years, until the parties achieve their goal. And the goals of each side are completely different.

We met several times in Oslo regarding the issue of exclusivity. S. N. Konyukhov's stubbornness escalated the situation to a critical point. Yu. P. Semenov even lost his temper once and flew back to Moscow without saying goodbye to everyone. All efforts from both the Russian and Norwegian sides were expended. But once burned by milk, one blows on water, as the saying goes, and this was very applicable to our case. S. N. Konyukhov belongs to those people who make decisions slowly, deliberating, but once a decision is made, it is impossible to make them deviate from it. All arguments about workload and the avant-garde project were exhausted.

G. P. Biryukov and I left S. N. Konyukhov and Per H. Kristensen alone. We had to walk around for about three hours. There was very little time left before our flight.

Finally, the protocol was signed (albeit with reservations). The main issue of exclusivity began to be resolved. This protocol had already been signed by Yu. P. Semenov. All that remained was to pick it up and head to the airport.

— You know, I have a very serious statement, — said Per H. Kristensen, — we need to think about how to secure the platform for ourselves more quickly. We need to pay an advance, otherwise the platform might go to others. You wouldn't object if Kvaerner does this?

We exchanged glances. S. N. Konyukhov looked at me.

— I don't object, — I replied.

— Very good. We will proceed.

We rushed to the airport. Only later did I understand what webs Per was weaving. But at that time, the task was different — to get the project started.

Boeing did not give up on the tanker. A representative delegation, as it was called — independent, arrived in Oslo. It was headed by a very likable American who led engineering developments at Boeing. He brought with him strength engineers, gas dynamicists, managers, and specialists in marine assets.

From Kvaerner, specialists from Norwegian Veritas and the engineering department were involved.

Our side was mainly represented by designers.

This was Boeing's last offensive against the platform.

We split into groups by specialty, and work began in earnest. We were so confident in the correctness of our choice that we gave detailed answers to any questions from the Americans, attaching calculations when necessary.

On the second day, I asked the Boeing leader to meet with me one-on-one:

— I would like to convey our thoughts to you. Perhaps this will help us understand each other better.

— I would be very glad to hear you out.

— We get the impression that Boeing doesn't want to hear our arguments. You have one goal — to withdraw from the project. If that's the case, then say so directly. There's no need, as we say, to fray each other's nerves. Let's find a form that suits you and remove Boeing from this project. We are fully confident today that the project is real. The rocket and upper stage exist. Kvaerner will build the marine assets, and the project can be implemented without Boeing. Think about this. How would that look?

He pondered.

— No. Personally, I like the idea, I can only assure you that we want to objectively evaluate all the pros and cons. Boeing has never abandoned advanced ideas.

— Thank you for your frankness. I hope so.

And so we parted.

I shared my conversation with Per H. Kristensen.

— We can't do it without Boeing. We alone cannot handle such a project. If you had the money, then it would be a different matter. And even then, we wouldn't be able to break into the launch services market without the Americans, because all Western satellites use American technology. Even if they are separate elements, they are in every satellite. We would hit a wall.

The commission worked for a whole week. To our delight, the commission's conclusions spoke of the advantages of the platform and the technical feasibility of the project. It seems that everyone at Yuzhnoye Design Bureau also finally believed in the platform. Another step forward was made.

Next was the stage of signing an agreement on technical cooperation between partners. This document was mandatory under US law. It states that foreign partners undertake obligations not to proliferate technologies, speaks of the confidentiality of the project, defines the boundaries of the project, and stipulates many other nuances on this topic.

Our American colleagues warned us that after we signed such a document, we would still have to overcome bureaucracy. This takes

months. Without the government signing such a document, which grants permission to work, Boeing simply avoided concrete discussions of spacecraft launches, their characteristics, and requirements for rocket systems. They asked us questions, to which they received answers. But as soon as we asked a question, we received silence in response.

A government representative, a “ditsa,” was always present at the negotiations. He carefully monitored what was said and what was asked by the Americans. They didn’t say anything superfluous, and the questions were such that it didn’t follow that we could learn the technology of manufacturing rocket equipment. This greatly annoyed us. Everyone involved in the project was eager to start concrete work as quickly as possible. But without knowing what we were launching, it was very difficult to determine specific technical solutions. The Norwegians didn’t like this either. Bjorn Lin — responsible for the technical implementation of the project from Kvaerner — was also stalling.

We adopted, as they say, a Solomon’s solution: to separate from the Americans, not to wait until they could provide their data, but to coordinate the marine and rocket systems.

— We propose to create a small group of specialists who will work here in Oslo for a couple of months. We would like there to be representatives from Energia, Yuzhnoye, and KBTM, — Per H. Kristensen proposed, — we will find them accommodation and provide everything necessary. Expenses will be accounted for later.

As for us and KBTM, there were no questions, but what about Yuzhnoye?

— We need a week’s timeout, — I replied to Per.

Upon arriving in Moscow, I reported to the General Director. He supported the Norwegians.

— I will talk to Stanislav Nikolaevich. I think we will come to an agreement.

Based on the results of the independent commission’s work, Boeing proposed another meeting in Oslo to finally agree on the main principles of the project’s creation, including a discussion of the financing scheme.

Such a meeting took place. The platform was finally recognized, but then we again ran into exclusivity. S. N. Konyukhov, at another partners’ meeting in Oslo, reached an agreement with the American firm Loral on the launch of three satellites with the Zenit rocket and absolutely did not want to let go of the initiative. All arguments that the rocket was not entirely Ukrainian, that if we created a Company, the profit would be greater, that there would be more orders because Boeing would

handle the marketing, he seemed not to hear. We assumed that he had already committed himself to Loral. Yu. P. Semenov spoke heart-to-heart with his friend several times, but the results were negative. Finally, he lost his patience.

— My patience will soon run out. Such a promising project. Does he really not understand that this is not a one-time job, that it's about loading the plant and his design bureau? Try to calmly discuss all the issues again. You need to convince him. It's almost time to appeal to President L. D. Kuchma, because it's a state matter.

After the General Director left, it was not my place to start such conversations. And here, credit must be given to Per. For several hours, he patiently explained to Stanislav Nikolaevich Konyukhov, one-on-one, the problems that had arisen in connection with the project. S. N. Konyukhov carefully studied all the papers prepared for signing, called Dnepropetrovsk, and finally presented his conditions.

— We will sign the documents, just give us three launches with the Loral company, and then we will join the Company with exclusivity for Zenit.

Per made several calls to America. And finally, a consensus was reached.

Again, there were 5 minutes left until the plane, and again Per made a statement:

— So that the platform does not go to Brazil, its price must be 42.5 million dollars, I have prepared the corresponding document.

My surprise knew no bounds.

— But we agreed on a price of 25 million.

— That was then. But we have a market, and the Brazilians offered more. If we don't give that price, the platform will go. The project will fall apart.

Thoughts raced through my head like mad. Just like that, we fought and fought for the platform, achieved it, and now the project is falling apart. After all, the platform was the cornerstone of the project. What will I tell the General Director? We settled things with Yuzhnoye Design Bureau, and now we're caught. There was only one way out — to sign the document. Per calculated everything precisely. It lasted only a few seconds. I took a pen and signed. S. N. Konyukhov signed after me:

— I'm like you. I don't know about all the earlier agreements. Here, I'm following you.

I flew to Moscow. How to report to the General Director?! I came, told him how it was. Unexpectedly for me, he met the news about the platform's cost calmly.

— Why are you worried? It's their money. That's why they determine the price.

— But the project price might increase.

— That's for Kvaerner to sort out with Boeing. And you, go to Oslo, take someone else from your side and KBTM, and disconnect the equipment. I've arranged with Konyukhov S. N. Fedorov V. N. will go.

Everyone met at Sheremetyevo-2. V. V. Liberman from our side, I. M. Perelman from KBTM, V. N. Fedorov from Yuzhnoye Design Bureau.

We were met, as always, by Per H. Kristensen with Irina and A. Areshhev.

— Let's go to the new residence. The house was just finished,
— said Per and drove us to our dwelling.

We settled on a quiet street, about twenty minutes' walk from the center. We went up to the apartment. The apartment was a studio, with a sofa in the living room, two armchairs, and a double bed in an alcove.

— Not much for four, — I thought to myself. I could see from their faces that my colleagues were also shaking their heads in surprise, wondering how four people could sleep here. One of ours looked into the pantry but found no cots there.

Noticing our glances, Per said with dignity:

— There are four such apartments on this floor, so it will be comfortable for all of you.

We smiled.

We quickly sorted out the apartments. Everything in the apartments was thought out to the smallest detail. In the kitchen — from forks, knives, plates, various openers to a toaster, coffee maker, microwave oven, electric stove. In the bathroom — a washing machine, shower, toilet. A full set of towels. In the bedroom — two sets of bed linen.

In short, everything was thought out to the smallest detail. All that remained was to unpack our personal toiletries, buy groceries, and live at our leisure.

We took taxis to work. Fortunately, there were many in Oslo, and the company paid all the bills.

Having settled in, according to Russian custom, we gathered at V. V. Liberman's, got a bottle, ran out for snacks, and celebrated our arrival day.

— We'll have to live here for a long time. I suggest we live communally. We'll each chip in 300 kroner to a common pot and spend it on food. When it runs out, we'll add more. We'll be having dinner and breakfast together anyway. Any objections?

Everyone agreed. Valentin Vladimirovich was appointed treasurer. Thus began our life in Norway. Before describing how the project developed further, I want to describe the situation and atmosphere we found ourselves in. And for us, they were quite unusual.

OSLO

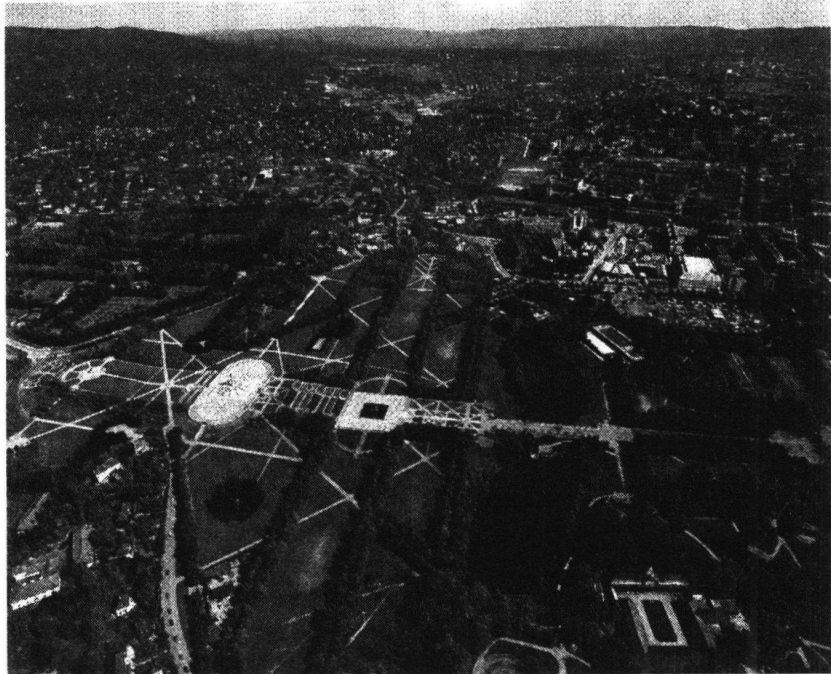
The city of Oslo is located by the sea in a picturesque area. Mountains seem to surround the city, shielding it from the northern wind. And the city, gradually expanding, began to move into the mountains, with special caution, trying not to harm Mother Nature herself. Roads, winding like a flexible ribbon, led to each house. And each house was beautiful in its own way.

Absolutely clean windows, well-maintained yards, and unusually beautiful decorative flowers caught the eye.

In the city center, life flowed unhurriedly. Guards stately march near the royal palace. No one is in a hurry.

Only the rustle of wheels betrays the movement of cars, and no exhaust fumes are visible when you watch them go by. As soon as you step from the sidewalk onto the roadway, the entire stream of cars stops, allowing you to cross. This was so unusual that sometimes we couldn't understand how it happened. At first, it seemed to us that something was wrong with the car, but when we saw the smiling person behind the wheel, who gestured for us to cross the street, everything became clear. We could only regret that, having gotten used to this, we wouldn't last long in Moscow.

Oslo is a very clean city. Sea air blows over it from the sea, but the most surprising thing is that you don't feel any humidity. You won't find bare ground in Oslo. Besides the asphalt and concrete of roads, sidewalks, and paths, everything is covered with a beautifully trimmed carpet of grass, and around shrubs and tree trunks — very large wood chips. Later, we saw how dry branches are cut, put into special machines, from which these wood chips are poured out; it's even hard to call them wood chips, but rather small splinters. These are used to sprinkle the root systems of trees.



Oslo. View of Frogner Park

The special pride of the Norwegians is the maritime museum. How lovingly they preserve history! They restored the first Viking boats, the first ships. And for the “Kon-Tiki” and “Ra” they built special pavilions. And what pavilions! With sea imitation, unusual lighting, many photographs, and video film demonstrations. Thor Heyerdahl — the brave explorer — has been elevated to the rank of national hero.

Frogner Park is also unusual, in the center of which a group of monumental sculptures reflects human life from birth to old age. We were told that the sculptor Gustav Vigeland (1869—1943) was unusually demanding of himself and of those who posed for him. He worked day and night, creating this extraordinary work in two years.

On the embankment, you can see ships from different countries that have, as they say, found a permanent berth here. Converted into restaurants, they look elegant and picturesque, as if inviting you to visit them. Old shipyards have also been converted into luxurious shops and restaurants. Despite such an abundance of restaurants and cafes, it is practically impossible to find free tables in them. To get in, you need to make a reservation by phone in advance. This, of course, does not apply to open summer cafes. They set up tables right on the street.

But even here, vacationers sit at tables, unhurriedly sipping Coca-Cola or beer. Nowhere did we see drunk or rowdy young men.

An atmosphere of friendliness and respect reigns in the city. To whomever you address, the first thing you receive is a smile, and then an answer. The abundance of small shops, open around the clock, where you can



Gustav Vigeland



In Frogner Park

buy any products, and the frequent location of gas stations made us wonder why we don't have this. We didn't expect that in four years all of this would be available to us too. In winter, Oslo is beautiful in its own way. The snow in the city is clean. Roads are cleared, all cars have studded tires — it's the law. In places with inclines and at traffic lights, large marble chips are sprinkled. In spring, they are collected by special vacuum cleaners, and in winter — back to work.

There are no police officers visible in the city, nor are there traffic controllers; they only appear when traffic jams and other road incidents occur. They don't catch you with a radar from behind bushes. Everything is controlled automatically. If you violate, exceed the speed limit — expect a significant fine; if you don't pay on time — expect an even larger one, and your insurance will cost twice as much next year. But all of this is done politely, without infringing on the driver's dignity. You immediately recall how the traffic police stop you in our country. For them, you are not even an offender, but a criminal.

I remember an incident when we were returning from a ski trip. We were driving unhurriedly. Suddenly, a police officer on a motorcycle overtook us and asked us to stop. It turned out that we had accumulated a string of cars behind us. Someone had called the police. The police officer very politely asked us to wait five minutes so that others could drive around us. He offered a thousand apologies while doing so.

It will be a long time before such a mindset is established in our country.

DETAILED DEVELOPMENT

Life in Oslo flowed according to its unhurried laws. In the morning — breakfast, taxi, work. The Norwegians took over the payment of our expenses. They paid for accommodation, transport, and substantial per diem allowances.

“Kvaerner” rented a special premise. Each of us was allocated a special room, well-equipped for work. Any office supplies, a direct phone line to Moscow, a good desk. An excellent photocopier.

We liked how the Norwegians approached the work. They appointed Bjorn Lin responsible for the technical part of the project for the assembly and command vessel, and Tomt Egil for the development of the launch platform. Unlike the Americans, they literally dug into the conceptual project we had developed by that time. The conceptual project contained fundamental solutions for the project as a whole. All components of the project were linked: the platform, the command vessel, launch areas, information transfer to control centers, requirements for modifications to the launch vehicles themselves, to the rocket and the upper stage, the main principles of launch control were described, fueling systems were defined, methods for cooling components were developed, gas supply and thermostatic control systems found their reflection, and methods for transferring rockets from one vessel to another, etc., were outlined.

We literally gave our ideas to the Norwegians. Later, we remembered this when they shamelessly patented methods for launching rockets from semi-submersible platforms. But it was too late. We learned a good lesson for our openness and goodwill. None of the Russians were listed among the patent authors. That’s how it is!

Consulting the Norwegians on rocket systems, we were convinced of their good engineering training. But what particularly struck us at that time was that literally on the spot, i.e., after talking with us, they would sit down at computers and start drawing their vessels. We were surprised that they did not demand, as is customary with us, signed initial data. Everything was done based on words, small sketches, but, of course, using our project.

“We’ve fallen behind with marine systems. But we assure you we’ll catch up,” Bjorn said. Bjorn, translated from Norwegian, means bear.

The Norwegians worked very diligently. For all our 8 hours, we didn’t see any idle people, smoking or arguing. We saw that

everyone in their office was doing their job and not getting distracted by extraneous matters. Drawings literally flew off the plotter, which was in a special room, but its productivity ensured the work of the entire Kvaerner Mos Technology team.

The fact that the platform was definitively established in the project was beyond doubt for anyone. But Boeing once again began to bypass our group, dealing directly with Yuzhnoye Design Bureau in Dnepropetrovsk. Their representative, V. N. Fedorov, was greatly disheartened by this, but could not prevent his management. We received a fax from the chief designer from Yuzhnoye, listing the advantages of the tanker.

“What’s wrong with them, have they gone mad?! It’s clear that the platform surpasses it in all respects,” Vladimir Nikolaevich fumed.

“Are you saying that with conviction?” I decided to test him.

“Absolutely!”

“Doesn’t it seem to you that you’re being ‘overwhelmed’ by authorities here?”

“Of course not! I’ll come and try to explain everything personally to S. N. Konyukhov. He’ll listen to me.”

“That would be right.”

The contours of the ship and platform were becoming increasingly clear.

“We need to estimate the cost indicators of the project,” Per H. Kristensen requested.

He avoided the question.

“A little later. Could you organize our trip to Baikonur?” he asked in return, “drawings are one thing, seeing everything in person is another.”

“I don’t think there will be any problems. We just need to report to the General and arrange the necessary documents. The General will support it.”

“Will you report it yourself or should I call?”

“As you wish.”

“Let’s do this: you talk, and then I’ll call. Okay?”

They agreed on that.

The main decisions for the marine segment were being concretized faster and faster. The moment came when everything was clear in detail, even if some individual points were not fully resolved. It was time to conduct an economic assessment. At first, I thought we would report our considerations to each other, and then converge on a “common ground.” But it turned out quite differently.

In the morning, Per H. Kristensen approached the whiteboard,

picked up a marker, and
said:

“In my opinion, everything will look decent if the funds are distributed as follows.”

And he quickly began to sketch out the components of the project and next to them wrote the cost of creation. He proceeded from a total project cost of 320 million dollars, i.e., from the figure we determined in Calgary.

In the conceptual project materials, the cost estimate for marine and rocket systems was approximately equal. But what I saw on the board shocked me.

Marine systems — 65%.

Rocket systems — 25%.

Marketing and payload fairing — 10%.

Engineering work and general expenses — 15%.

“I don’t agree with these figures. 79 million for rocket systems is simply unrealistic.”

“There will be no other figures.”

“Then there will be no project.”

“So be it,” Per said maliciously, “You must understand that for us, when it comes to metal investment, it’s an order of magnitude more. And the cost of metal at Western rates is,” and he named a figure.

“But you can’t compare the cost of one kilogram of dry rocket mass with one kilogram of ship metal. According to our technology, we must confirm every component. If something is wrong, it can be corrected on the ship, but not on the rocket. It lives for minutes, but the responsibility and reliability are great, all processes are fleeting. You cannot compare one kilogram of watches with simple metal.”

“Slava,” Per said instructively, “you must not forget that your political situation is unstable. How will our shareholders view this?”

Then I remembered our visit to the Norwegian millionaire Divi, as one of the project participants for investments (at least that’s what I thought then). He asked me one question:

“Is V. V. Zhirinovsky serious or not?”

“V. V. Zhirinovsky is not serious, he will not be president. Even if he is, there is no turning back for us. The whole system is broken. One person decides nothing.”

He nodded contentedly and asked no more questions, neither technical nor organizational.

Per was right to some extent. There were no strict laws in our beloved country yet. There was a search for directions of development, and this constant lurching from one direction to

another greatly worried foreign investors.

"You know, Per, in any case, we shouldn't work at a loss."

"That's true, but with a different project scenario, there might not be a project at all."

In the morning, I found that neither Per nor Irina was there. As it turned out later, they had urgently flown to Cyprus, where the General was spending his short vacation. They returned about five days later. Per looked at me triumphantly:

"Has Yuri Pavlovich called?"

"No, I haven't reported to him yet. He's on vacation."

The General's call was not long in coming.

"Come here, we need to talk."

From his tone, I understood that nothing good could be expected from such a conversation.

"What are you arguing about there, they're paying money, and you're resisting," he said irritably, "go work out what can be done to fit within the allocated price."

At that time, it was very difficult to understand what would happen to prices. Prices were jumping like crazy. It was impossible to predict for a month, let alone for years. I called the head of the design department, R. K. Ivanov, to my office.

"Try to distribute this amount across all systems, can we stay within the figure allocated to us?"

"How much time do you give me?"

"You know, the General will start bothering me today."

"Understood."

Robert Konstantinovich was one of those people who, with a good understanding of technology, could quickly conduct an analysis and broadly determine possibilities.

Yuri Pavlovich started asking questions by evening.

"Well, how is it? We need to fly to Per. When?"

"Give us at least a couple of days."

"We're planning the trip for next week."

R. K. Ivanov's team worked, in my opinion, around the clock. They distributed the limits by blocks, by systems, but they put the budget together. Under certain conditions, one of which was that prices would not jump sharply upwards, we could fit into the project. This suited the General. During the flight, he looked at the figures for a long time, but now he doubted their reality:

"We need to ask for at least five million, let that be your reserve, and clarify the scope of work."

"Okay, we'll talk when we meet."

As always, Per and Irina met us personally at the airport in their luxurious car.

We arrived at the office. Spread out the materials. Valentin Vladimirovich Liberman spoke in detail about the work done. Per listened with satisfaction, then placed his slide with prices for the components on the projector. The prices for the rocket segment were again the same ones he had shown the first time.

“What are we going to do?” Yu. P. quietly asked me.

“We need to ask for at least five million.”

“And then what? Will we make it?”

I understood that Yu. P. was tormented by doubts.

“We can make it, but there are many ‘ifs.’ One of them is ‘Yuzhnoye,’ how it will behave, how the subcontractors will behave. If we immediately conclude contracts at today’s prices and finance them, we can put the project together. Here, we can’t do without your support. We’ll have to fight with everyone. I’ll be enemy number one to everyone. You need to understand that.”

“Alright, I’ll ask for another five million, and we’ll work.”

He turned to Per, who was calmly sipping tea with feigned composure, watching us out of the corner of his eye.

“You know, Per, it will be difficult for us to stay within these figures. Today, we don’t know what will happen to prices tomorrow. I need a reserve, at least five million.”

“You see, Yuri Pavlovich, we are already taking a very big risk, considering the unstable political situation in your country, and there are no guarantees that everything won’t collapse. We will have to seek government guarantees.”

“We will achieve that, I have no doubt.”

“I think we will give these five million, but we need guarantees from you that prices will be frozen until the end of the project.”

“But this must be mutual from both sides. We must hold the prices.”

They agreed on that. The price of the rocket systems was set at 83 million, with a total project cost of 380 million dollars.

“S. N. Konyukhov worries me a little. I hope he doesn’t pull anything. But I think he’s reasonable, he’ll understand that we had no choice,” Yu. P. concluded.

On the occasion of such an agreement, Per invited us again to a luxurious restaurant, whose chef, according to him, won first place in a competition in Europe.

The restaurant was located in a mountainous area. From its terrace, there was a beautiful view of Oslo. Dinner was formal, by candlelight. Per again ordered his favorite dish — “saddle of lamb,” and we followed his advice. At the table, conversations revolved around the project, how it was a world first, etc. After dinner, we visited a cafe on the 26th floor, had 30 grams of cognac each. We

looked at the surroundings and then went our separate ways.

In the morning, the General flew away. Our group continued its work. The project was undergoing final detailing.

Baikonur. This word brought the Norwegians into extraordinary excitement. They were very eager to see the launch of “Zenit” as soon as possible.

And so, in May, such a trip was organized. Per asked, in addition to specialists, for permission for millionaire Divi and the president of the large “Kvaerner” Mr. E. Tønseth with his son to visit the cosmodrome. All formalities were settled. Although in those days, getting permission to visit the cosmodrome was a very troublesome matter. The trip was timed to coincide with one of the launches of the “Progress” spacecraft.

The Boeing executives also didn’t want to miss such a trip. Vice President James P. Nable and Commercial Director Patrick S. Inyart flew specifically to Moscow with their translator Natasha Magvaer. A former native of Kharkov, she never seemed to be discouraged. Energy flowed from her, and what she did for the project requires a separate narrative. She taught us how and what to say to Americans, to whom one could speak openly and they would understand, and to whom it was useless to speak. She was a translator, secretary, and also a good advisor for James P. Nable and Patrick S. Inyart. She could smooth over many tense moments through humorous translation, and the conversation would then return to normal. Their young leader Ellen Ashby — the future president of Sea Launch — also flew with us.

So, in this group, in September 1994, we flew to the cosmodrome with the General. In the morning, we had to gather everyone from their hotels, and then proceed to Vnukovo-3 airport — our base.

The Tu-134 aircraft was serviced like the best flight of a foreign company. A. L. Martynovsky knew a lot about this. So the flight passed unnoticed. And we, accustomed to such flights, were very pleased with the courtesy of our flight attendants.



Vnukovo-3. Baikonur ahead

Spring was gaining strength at the cosmodrome. Tulips had faded, but the heat had not yet arrived.

Our plane with the General landed at Krainy airfield in Leninsk city around noon. The gangway was brought. Everyone rushed to meet Yu. P., somehow forgetting about the guests. Luggage was unloaded, and minibuses soon arrived. We drove to our native Site No. 2. The guests were accommodated in a newly renovated hotel. The rooms were neatly cleaned and tidy. Refrigerators were stocked with mineral water, fruits, and snacks. Everything was good, only one drawback — there was no water: neither cold nor hot. The problem of washing, brushing teeth, and other hygienic needs remained unresolved. But they promised to provide water by morning. We were given an hour to settle in.

We went to the site, to the “Zenit” facility, looked at the technological equipment at the technical complex, then at the launch pad.



Baikonur. At Site No. 2

The military had prepared for the arrival. By order of the cosmodrome commander, General A. A. Shumilin, the fueling mockup of the Zenit rocket was already on the launch pad and ready for installation on the launch table. The Norwegians: Lin Bjorn and Tomt Egil photographed literally everything related to the elements of the rocket's lift. This is understandable. They were the ones who designed the marine vessels.

The Americans looked at everything with curiosity and interest, but kept somewhat in the shadows.

The lift and simulated installation of the rocket onto the launch table went without a hitch. Only the photographers had to move further away so that the entire 60-meter behemoth would fit in the frame. We returned to site number two.

During dinner, it turned out that D. Nable had to fly to Moscow. We, however, had planned our departure only for tomorrow. There was no other plane. It took a long time to explain to Mr. D. Nable that it was impossible, that there were no other planes. He didn't understand for a long time, but eventually resigned himself.

Natasha Magvaer and I had to call Moscow, and she had to apologize for D. Nable's absence. Everything was settled.

On May 27, 1994, the entire delegation went to the observation deck to watch the launch of a Soyuz rocket with an unmanned Progress spacecraft. Many of the guests were witnessing a rocket launch for the first time. The spectacle of launches, especially of the

“seven,” is simply mesmerizing. The bright flame of the engines and the roar made everyone literally stare at the rocket. And it, as if reluctantly, lifted off from the launch pad and, gaining speed, quickly carried the spacecraft into the vastness of the universe. Its trail was visible in the sky for a long time, like a lingering tail, slowly dissolving high in the atmosphere.

After the launch, it was suggested to visit the museum located at Site No. 2. Here, exhibits of launch equipment were collected, rocket models were displayed, and what particularly interested our guests was a model of a cosmonaut's chair. They took turns sitting in it and taking pictures.



At the Zenit launch complex

After lunch, we flew to Moscow. I think everyone was satisfied with this trip. Probably, for the first time, a combat rocket was shown to foreign partners.

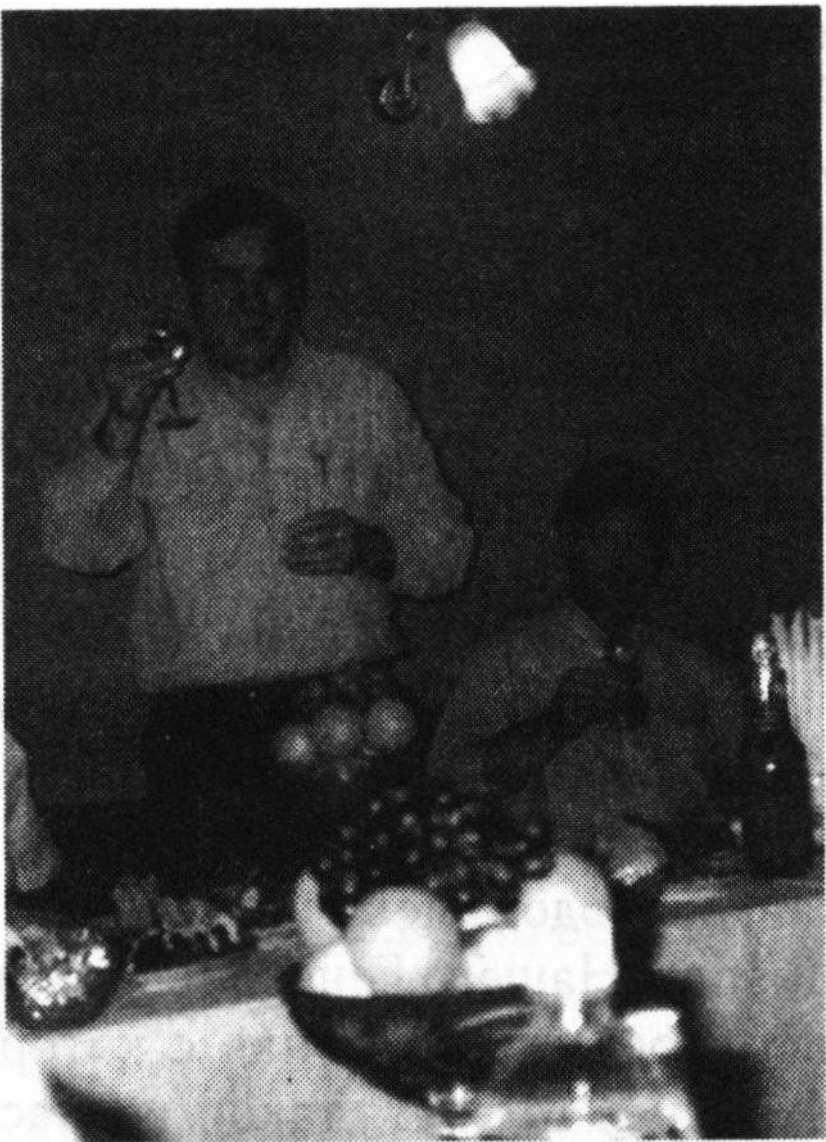
We had a strange attitude towards such things. We forbade everything we could.

We spent enormous amounts of money on it, even saying that you worked in rocket technology was considered a crime. Americans approached secrecy differently. They did not hide the external appearance, published product characteristics, operational features, and printed mass summaries. But, as soon as we analyzed the published materials, the mass summaries did not match, the characteristics were contradictory, and how it was made or achieved, i.e., the technology of creation, was under lock and key for them. They protected the key moments of creation. This was cheaper and more effective. We did something similar at Baikonur. We showed the external appearance, which was well known to

them from other sources, but did not reveal the manufacturing technology, although our colleagues' questions were precisely directed at it.

The trip to Baikonur significantly helped us with further technical explanations, as well as the Norwegians. The platform quickly gained the missing project details, but work on the vessel took a different direction.

Initially, they wanted to use a "Ro-Ro" type car carrier for the command vessel. But when they calculated the cost of its conversion, plus the purchase expenses, it turned out that building a new vessel specifically for these purposes was faster and cheaper. The Norwegians quickly identified the manufacturer. Of course, it was one of Kvaerner's enterprises. They developed the project and rushed to build the vessel using an accelerated method with the most modern technology. Our specialists had to work very closely with them, issuing requirements for each workplace, each room of the rocket segment, for the assembly hall of the space rocket, and the premises where the upper stage was tested, and its service compartments.



Toast from Boeing management at lunch at Baikonur. D. Nable and D. Schnitler

The project development moved into the realm of issuing specific working drawings.

The behavior of our partners from the Yuzhnoye Design Bureau caused doubts. They again initiated correspondence with Boeing about the need to return to the tanker. It seemed as if this tanker, with a displacement of about 300 thousand tons, was sitting on the Dnieper. Our General was very annoyed by this. And credit must be given to his patience, with which he persuaded the General from Ukraine. Perhaps their attitude was a result of jealousy towards our enterprise? Why wasn't it them, but "Energia," that initiated such a

project, where the “Zenit” rocket played a significant role? After all, “Zenit,” as they believed, was a Ukrainian rocket, and they should have taken the leading role in the project. This was purely socialist thinking. Time later put everything in its place.

We had to overcome certain technical difficulties, as due to such a position of the Yuzhnoye leadership, we could not obtain sufficient information about the rocket. Personal contacts were needed to settle all relations.

I call V. N. Komanov, we consult on how to smooth relations, normalize them.

“Maybe you and your wives could come visit us for a couple of days,” he invites, “we’ll discuss technical matters and you can relax. The trip will be useful.”

“Probably. You suggest to Stanislav Nikolaevich to contact Yuri Pavlovich.”

The idea was picked up. Stanislav Nikolaevich Konyukhov’s persistence is undeniable; he managed to persuade the General.

“Go ahead and organize the trip: who will go, souvenirs. Invite B. I. Katorgin, he’ll have to work with us for a long time.”

A. A. Borisenko (our factory director) will fly with us. I’ll tell A. L. Martynovsky myself.

Thus, the composition was practically determined.

The hour-long flight passed unnoticed. The welcome on the ground in Dnepropetrovsk was very warm. They met us like family. Many of us had our destinies linked to this city. Yu. P. Semenov and

A. A. Borisenko graduated from universities here, B. I. Katorgin, A. V. Safonov, and I were connected by many years of joint work.

The General was the happiest of all. He was relaxed, constantly joking. It turned out that he and S. N. Konyukhov lived in the same building, and their argument about who lived on a higher floor and who on a lower floor added to the cheerful mood of those around them. They quickly discussed technical issues and went for a walk around the city. The weather was sunny, the golden autumn was pleasing to the eye, and it seemed that everyone around was in a good mood.

We walked through the park. Approached the church. There were many people in the square in front of it. We noticed that the church was locked, and the service was being held outside. They looked at us hostilely. We stepped aside and stopped. Curiosity got the better of us. B. I. Katorgin approached a woman.

“What’s happening here?”

She looked at him contemptuously.

“As if you don’t know!”

"No. We just flew in from Moscow today."

The woman's gaze instantly changed, softened.

"So you're from Moscow, from Russia?"

"Yes."

"Why did you abandon us?" she said, as if bitterly confirming what had happened.

"?! " There was no answer.

"And here," she continued, "some young thugs came, introduced themselves as being from OUN, and ordered a service for the repose of Bandera. Some anniversary. When the priest refused, they promised to come back in two days and burn down our church. So the priest appealed to the faithful. And we gathered. He locked the church and is holding service outside. Please forgive us, we mistook your group for those thugs."

More women approached. They looked at us with curiosity, but there was no hostility in their eyes. All we could do was express our sympathy. We went into a store. Just to see what was on the shelves. We decided to buy ice cream.

"Oh, girls, Russian money!" exclaimed the saleswoman. "Where are you from, dears?"

Everyone rushed to look at our rubles as if they were a curiosity.

"From Moscow."

"How are you there? Why did you leave us?"

— ?!

"Who did this? Who separated us? We lived together, as one family, and now this. We can't even go to bury relatives. They invented customs, borders. What borders?! Who is fencing themselves off from whom?"

Questions, questions, questions.

Yes, much had changed in two years, when everyone became independent. Europe is uniting, borders are disappearing, but with us, it's the opposite. It was strange to hear, and most importantly, to feel the pain of ordinary people.

The project development, as is customary with us, began with the issuance of a short document called "Tactical and Technical Requirements for the Complex." In the "Sea Launch" project, it is not possible to define requirements at the beginning of the project without working out individual details. Therefore, we, together with the Norwegians and Americans, worked almost all of 1994 on the project according to separate, disparate, but, as it seemed to us, logical requirements. The time came to issue the requirements for the complex. Our designers developed such a document. Its drafts were sent to our partners, and in early December, we gathered in

Moscow to discuss and sign it. All partners liked the document. It defined where and what mass the complex would launch, the working orbit of the apparatus, the composition of the complex, the number of launches per year, launch accuracies, requirements for operational reliability, requirements for the measurement complex, for the marine and continental segments, requirements for operation, storage, and maintenance, requirements for safety and environmental protection, requirements for resistance to external influences, for manufacturability, for ergonomics. All these requirements were uniform for all project developers.

In addition to technical requirements, it was necessary to reflect a common understanding and requirements for economic factors, the creation of commercial secrets, stages of work, and reporting on stages.

During the discussion of the document, we discovered an amazing understanding from our colleagues on all issues and concluded that both the Americans and the Norwegians worked in the same way. True, they began their work with a business plan. This document was more voluminous and mainly focused on project profitability, but the technical part was reflected in it.

The developed tactical and technical requirements were a preceding phase.

In a solemn atmosphere on December 6, 1994, the document was signed by the participants of the negotiations and then approved by the heads of enterprises Yu. P. Semenov, S. N. Konyukhov, P. H. Kristensen, and P. S. Inyart. This was the first joint document of the partners. Before this, there had been correspondence between the parties on individual issues, but here everyone came to unified requirements for the complex. The partners began to work together.



12/06/94. Signing of the first technical document

The question of creating a joint Company was still being discussed, but a step forward had been made in terms of technology.

Project meetings, as a rule, took place in Moscow or Oslo. It would be unfair to bypass Dnepropetrovsk, and S. N. Konyukhov invited everyone to visit his city. To discuss further work there, and at the same time see the factory that produces rockets. The invitation was gratefully accepted. And so, in early 1995, all partners (except, of course, “Yuzhnoye”) gathered in Moscow. The General gives the command to prepare our plane. Yu. P. Semenov, D. Nable, Vice President of “Kvaerner” D. Schnitler and their accompanying persons — on the plane. It heads for Dnepropetrovsk.

The weather does its job.

“Dnepropetrovsk is not accepting,” reports chief pilot V. I. Pyatkin.

“So what?”

“There are two ways: one is to return, the other is to land in Zaporozhye.”

“Return? Again these problems with customs officers? No, let’s go to Zaporozhye,” the General decided.

“And how many kilometers to the Dnieper?”

“About 100-120 kilometers.,,

“Can we inform those meeting us that we are flying to Zaporozhye?”

“Of course.,,

“So that’s what we decided.”

One can only wonder how our ship commander landed the plane at Zaporozhye airport. The rain was pouring down, visibility was zero, one simply marvels at such professionalism.

Another country. Ukraine. It sounds so strange. Another country. I want to tear my head off and throw it away for this. Who would have thought that they would make us, Russia and Ukraine, different countries!

The plane stopped at the airport terminal building. The gangway was brought. But none of those who had arrived rushed to the open door. The weather was not pleasant.

I often fly by plane. And what is especially memorable is how passengers behave.

The flight lasts an hour, maybe three hours. Sometimes, I had to be in the air for eleven hours. But it's always the same. As soon as the plane's landing gear touches the runway and it starts to taxi to the parking spot, everyone jumps out of their seats. In vain do the flight attendants ask not to get up until the engines have completely stopped. Practically everyone jumps up, lacking patience for another 5-10 minutes, regardless of how long the flight lasted. In our case, this did not happen. Suddenly, a border guard major appeared in the doorway. We greeted each other.

He asked where the plane was from, who had arrived. He listened calmly, but when he heard that there were foreigners on board, he was very surprised.

"We haven't received any messages. I don't even know what to do."

He began to explain that we were flying to Dnepr, that due to the weather we ended up

in Zaporozhye, that we were being met in Dnepr and were already on our way here. We weren't even planning to get out. The major listened, but it was clear that doubts gnawed at him.

"What's going on there?" asked the General.

"Border service."

"We've come to this. So what?"

"The major doesn't know what to do with us."

"Take some cognac and try to calm him down."

I stepped out of the cabin. The border guard stood lost in thought.

"Don't worry. Everything will be clear in about 40 minutes."

"Why in forty?"

"We've already informed Dnepropetrovsk that we were forced to land in Zaporozhye. They were meeting us there. Now they're coming here. They'll bring all the permits, don't worry."

The major warmed up a bit. Outside the door, the rain was still

pouring.

“Let’s have a drink instead,” I suggested to the major, pointing to the cognac.

“Can’t. On duty.”

“And when does it end?,”

“It’s already over. And then you show up, on my head.”

“And if it’s over, then...,” without finishing the phrase, I poured more than half a glass of cognac and offered it to the major.

“You’re all wet.”

“All the more reason. You can’t catch a cold. You still have a long time to serve.”

The major no longer resisted, only noting that the cognac was good. I immediately offered more. Suddenly, Yuri Sergeevich Alekseev appeared in the doorway of the plane.

“Hello!” he exclaimed joyfully. “Where is everyone?”

“In the plane. There’s a small delay with the border guards.”

“We’ve already sorted that out. His assistant showed all the permits.”

“We are happy to welcome everyone to Ukrainian soil. We are glad to have guests,” he said as he entered the cabin.

He warmly greeted everyone.

“A bus is waiting for you at the gangway. Please. It’s late, and it’s more than an hour’s drive.”

We got into an “Ikarus” bus. A police car with a flashing light led the way, and we set off.

Yu. S. Alekseev — the director of Yuzhmashzavod — was probably the youngest director at that time. But his business and organizational abilities spoke for themselves. He thought through everything to the smallest detail. He didn’t complain in difficult moments, but, on the contrary, became more energetic.

We were surprised how everything fell into place.

We were accommodated at the Yuzhnoye Design Bureau’s recreation center. A beautiful place, beautiful buildings, but everything was not the same. It was clear that financial difficulties were taking their toll. It felt like these buildings and plumbing hadn’t seen repairs in a long time. And the bedding, despite being clean, was quite worn. This was noticeable, especially after visiting the West. We gathered in the dining room. During dinner (which, as always in Ukraine, was abundant and delicious), we determined the program for tomorrow.

In the morning, two “Rafiks” and a “Volga” arrived. We went to the factory. For some reason, drivers, when they learn they are carrying foreigners, start showing off their prowess, simply driving recklessly. Ours was no exception. He sped, ignoring prohibitory

signs, made dangerous overtakes, even to the point of heading for a head-on collision with an oncoming car.

"Irina, translate," Per asked, "if he continues to drive like this, I will get out and walk."

Irina translated. This cooled the driver down. The ride became more pleasant and calm. Such a remark could cost him his job, and finding another one was difficult.

Here is the factory. We walked through the workshops. Yu. S. Alekseev personally, with the production manager V. M. Sichev, proudly showed off his facility. The assembly shop was built for the Buran ISS project. Huge and clean, it impressed our guests. We looked at the welding equipment, assembly jigs, and the control and testing station. Everything indicated that rockets in the Soviet Union were not made "on the knee," but that it was a complex technological process and the most advanced equipment. And although there were few workers, and the factory was on the verge of stopping, even our guests understood that there would be no problems with the "Zenit." We looked at the engine shops. And again, the production equipment commanded respect for its creators.

We moved to the Design Bureau, right there on the factory grounds. The Yuzhmash factory is a production complex. Before the meeting, coffee and tea were offered. We freely exchanged opinions about the factory. Everyone liked it. The meeting room, where the Council of Chief Designers usually held its meetings, was small but very cozy. S. N. Konyukhov welcomed the guests, expressed hope that together we would overcome the project. The project, in his opinion, was very interesting and promising. He said that they had thoroughly worked out not only the technical side but also the economics of adapting the "Zenit" for sea launch. Everyone nodded their heads in satisfaction and awaited further developments.

The floor was given to S. N. Konyukhov's first deputy, Smetanin Yu. A. He began to describe and demonstrate on slides the main works, as he called them, major milestones for the modernization of the "Zenit." D. Nable, P. Inyart, P. Kristensen, D. Schnitler looked at the final figure for the modifications. They listened politely, heads bowed, but their mood changed.

They began to explain that the entire adaptation phase consists of three main parts: the development of design and engineering documentation, the development of systems and units, and finally, integrated and flight tests.

After the announcement of the first cost of design work, which concerned the strengthening of the hull, integration with the third stage, and the development of a new fairing costing more than four

million dollars, our General could not stand it:

“Stanislav Nikolaevich, what is he talking about? Does he realize what he’s saying? Stop him, you see the reaction. Please do not translate my words.”

“Let him speak. These are not decisions, but our considerations. Let’s listen.”

The development of systems was estimated at twenty-six million.

“What is he talking about?” Yu. P. fumed.

The report continued. Integrated tests were estimated at thirty-five million. Again, outrage. And the final point was made that an additional four and a half million were needed to increase the safety and reliability of the Zenit launch vehicle. Yu. P. could not bear it:

“These figures are unacceptable. That’s out of the question. If we accept them, the project can be shut down.”

“Why shut it down? Let’s discuss it,” S. N. Konyukhov suggested.

“There’s nothing to discuss here. Consider the project failed,” declared Per H. Kristensen. He looked at his American colleagues. They nodded their heads in support of what Per had said.

The guests stood up. There was nothing to talk about. The General approached S. N. Konyukhov.

“What have you done?”

“But these are only preliminary discussions.”

“Do you see what happened?”

“We need to sort this out somehow.”

The business part was over. But no one refused lunch.

At lunch, S. N. Konyukhov began to extricate himself from the situation. He behaved at the table like a thrifty host. He constantly gave toasts, spoke about his friendship with our General. This was true. Despite different positions, both Stanislav Nikolaevich and the General maintained family relations. I happened to witness one conversation between Yuri Pavlovich and Natasha — S. N. Konyukhov’s wife — when he asked her to influence her husband so that he wouldn’t get too heated.

Gradually, the atmosphere at the table warmed up.

“I propose organizing a working group to conduct a cost analysis,” S. N. Konyukhov suggested.

“That’s your business,” D. Nable said. “We don’t want to participate in such a discussion. If you (he meant Russia and Ukraine) don’t stay within the limits, we’re leaving the project.”

Yu. P. intervened:

“Let’s sort things out among ourselves first, and then we’ll

meet.”

With this, he seemed to support S. N. Konyukhov.

“We will work with Yuzhnoye.”

Lunch ended in a friendly atmosphere. We drove to the airport. Our plane was waiting for us at Dnepropetrovsk airport. We said our goodbyes peacefully. We set a deadline of 10 days for the expert review and flew to Moscow.

— I understand that the difficult financial situation forces southerners to inflate prices,— Per reasoned, as if talking to himself,— but they must understand that only with such a Company of serious partners can one count on success. The project could have been buried today, but we believe in the reason of the “southerners.” This is their prospect. You will have a difficult task to tie the numbers together and not let the project fall apart,— he concluded, addressing me.

— Yes, the task is difficult, but achievable. We agreed to meet next week.

The General called me over:

— I know you’re prickly, don’t get heated, but calmly discuss all the points. You understand what’s at stake, don’t you?

— I understand, we’ll prepare and, I think, we’ll come to an agreement.

A week later, back to Dnepropetrovsk. This time, their attitude towards us had changed. There were no longer talks about the rocket being ours, that we determine the price, etc. The discussion was constructive. I explained that if we didn’t fit within 83 million with our systems, the project would collapse. We understood our Ukrainian colleagues well. They had no orders from their government. Although the former general director of YUMZ, Leonid Danilovich Kuchma, became the president of Ukraine. Even that didn’t help the Dnepropetrovsk cluster. Obviously, the President had many problems without missile technology.

DNEPROPETROVSK

Dnepropetrovsk. So much was connected with this city. Here passed the best period of my creative path. It was with the Yuzhnoye Design Bureau that the creation of the rocket block for the lunar spacecraft was linked.

In the small book “Memories of the Lunar Spacecraft,” I described in detail how it was. With deep gratitude to the people with whom I had to work at that time, I remember that period. The city occupied one of the leading places in the industry of the Union. Thanks to the fact that the General Secretary of the CPSU L. I. Brezhnev was originally from Dneprodzerzhinsk and once worked as the secretary of the Dnepropetrovsk regional committee, the city was in plain sight and received close attention from the center. Suffice it to say that the director of Yuzhmash A. M. Makarov could freely call L. I. Brezhnev himself, which spoke volumes.

The city was founded in the spring of 1776 at the mouth of the Kilchen River by Catherine as the “third capital of the Russian land,” the center of the Novorossiysk region, and a state outpost in the south. Around the same time, other cities emerged: Kherson, Nikolaev, Nikolopol, Odessa. Since then, the city has experienced many events, including devastation during the Civil War and the Great Patriotic War. But the city did not disappear; it recovered, new factories and enterprises were built, and new higher educational institutions were opened.

Today it is a city of machine builders. Electric locomotives and dump trucks, tractors and paper-making machines, metallurgical and mill-elevator equipment, electric motors and household refrigerators, tires and televisions, sewing and food concentrates, varnishes and paints, medical equipment and leather shoes—all this is produced by the city’s industry. The city has 30 research institutes and 9 universities. But the special pride of the city is the “Yuzhny Machine-Building Plant.” It was this plant that forged the rocket shield of our Motherland. A plant of the latest technologies, which are not even found in the best foreign factories of a similar profile. A plant where product quality is given paramount importance. A plant whose people are capable of mastering the most advanced technology and putting it into mass production—it is a plant of thinking people who constantly introduce new and new inventions into the technological process, improving product quality and reliability. This is a whole school of highly qualified personnel, patriots of their plant. It is very pleasant to work with

such an enterprise. The plant's management never shied away from solving complex, and sometimes simply critical, issues. This was true under A. M. Makarov, L. D. Kuchma, and Yu. S. Alekseev. A businesslike approach to finding solutions and the desire to provide work for people were paramount for these leaders.

The Yuzhnoye Design Bureau, located on the same territory, gave special strength to the plant. At one time, they even merged into a scientific and production enterprise, then again became independent. But the proximity of the designer and good business relations helped the factory workers master new technology at an accelerated pace.

The masterpiece in rocketry of this plant was, undoubtedly, the "Zenit" rocket. This was essentially one of the last developments of the Union. It embodied all the latest design, production, and technological solutions. This rocket was the focus of the "Sea Launch" project.



During negotiations at the Yuzhnoye Design Bureau. In the foreground: B. Katorgin, Yu. Semenov, A. Borisenko. Standing: S. Konyukhov

Long disputes about whose rocket it was: Ukrainian or Russian, continued in the press. But everyone acknowledged that without Russia, the Yuzhmash plant would not have been able to build such a rocket. However, just as Russia would not have been able to build a rocket without Ukraine. The cooperation of performers was so intertwined in the Union that its collapse undoubtedly led to the collapse of cooperation.

To the credit of the rocket scientists, who had close ties that turned into personal friendships, and who most steadfastly endured this collapse, the rocket industry lasted for more than a decade after

the collapse.

Indeed, some of the best rocket personnel were in Dnepropetrovsk. Fate brought me together with many: V. S. Budnik, M. K. Yangel, V. F. Utkin, V. G. Komanov, I. A. Lobanov, V. M. Kovtunenکو, I. I. Ivanov, S. N. Konyukhov, and many others.

The Yuzhnoye Design Bureau and the city became famous for their creativity and the creation of the Motherland's rocket shield.

Dnepropetrovsk residents are particularly proud that their fellow countryman, Leonid Danilovich Kuchma, was elected President of the Republic of Ukraine in the second all-Ukrainian elections. This is a tribute to the city, its industrial power, and a tribute to its working people.

A STEP FORWARD

At Yuzhnoye Design Bureau, there was a complete lull. It seemed as if people's tools of production had been taken away, and they, as if half-asleep, slowly moved through the corridors. The Design Bureau—once one of the best in the Soviet Union, which worked for the defense of our mighty Motherland, creating the most formidable combat missiles capable of destroying not only a city but also a country in a single salvo. The Design Bureau, which was proud of its achievements in science and technology, whose people could not doubt their necessity to the country even for a minute, people responsible for their involvement in secret space developments—now found itself alone with its fate.

Ukraine had no time for missiles, much less for space exploration, although the production of the Ukrainian satellite “Sich” had already been launched as the Union was breaking up. There were no defense orders, which meant that people were left without work, without jobs, without salaries.

Sometimes you think about what kind of state was created—the Soviet Union, in which scientific and technical groundwork over ten to fifteen years allowed our technology to be competitive. It was only later that scientific institutes began to close, such giants of science as TsAGI, CIAM, TsNIIMash, and others began to drag out a deplorable existence; the design bureaus did not give them work, and the government did not give work to the design bureaus, and then the chain went to the factories, then to the energy workers, miners, and so on.

The terrible crisis did not bypass Yuzhnoye Design Bureau. The leadership swore allegiance to Russia. They wanted, as in Soviet times, to be mighty, to manage factories not only in Ukraine but also in Russia. But times were already different.

By the time of our arrival, it was clear that instructions had been given not to quarrel with us, but also not to lose, and on the contrary—to try to convince us that they also needed money. We understood this well. After all, our comrades and friends worked at the Design Bureau, we studied together at the institute, and it was not their fault that fate threw some to Moscow, others to Dnepropetrovsk. We also tried not to be stingy when talks about the price of work began. Well-educated people (and we worked directly with Yu. P. Brylev) also tried to approach the solution of the task objectively. We had no choice, we and the “southerners” had to stay within the cost limits allocated to us by the cunning Per H.

Christensen. Yu. A. Smetanin pursued a somewhat peculiar policy. As the first deputy general designer, he contacted the American company “Loral” and believed that this was the most reliable venture, and “Sea Launch” was just toys. True, they did not talk about the launch date—that was their commercial secret—but their attitude towards our topic remained negative.

Fruitful work with Yu. P. Brylev concluded with a protocol, in which the total limit of funds allocated for us and Ukraine was agreed upon. We even added a couple of million dollars over the estimated amount for the work of Yuzhnoye Design Bureau and agreed with the Yuzhmash plant on the sale price of the launch vehicle itself. Here again, I want to emphasize the understanding and foresight shown by the young director Yu. S. Alekseev.

Yu. S. Alekseev saw not only the price, which was, of course, catastrophically low, but he saw the prospect for his rocket, which means: future orders and plant loading. He very carefully expressed his attitude towards the General Designer when we appealed to him as an arbitrator. We told him that the General’s imperial policy would not lead to anything good, that we had high hopes for “Zenit,” but without Russia, “Zenit” might not exist. One cannot pursue such a policy; it is neither comradely nor partner-like. Yuri Sergeevich never answered us, but I think he had more than one serious private conversation with his General.

We returned to Moscow, and I reported to my superiors that we had met the budget, and that things were starting to take on a concrete business character. I showed them the decision—the protocol with all the “southerners” signatures. Yuri Pavlovich was pleased:

—And what? Did Stanislav Nikolaevich (Konyukhov) agree?

—What else could he do?

—He is usually very persistent and doesn’t like to change his mind.

—But this isn’t an opinion. He gave the Americans the go-ahead to work on the numbers. So we worked, laid everything out clearly. We analyzed the technology, and then the cost figures emerged by themselves.

—How did you manage to meet the limit, since one rocket costs quite a bit?

—We deducted it from the limit. If we include the rocket, we won’t be able to stay within the allocated limit. This will need to be discussed with Per.

—Do you think you’ll find common ground?

—I think so. It’s unrealistic to stay within the limit with the rocket anyway.

—Fly to Oslo. Show them the protocol, reassure them. And I'll call D. Nabliitt.

We parted ways on that note. I returned to my workplace and called Irina. I asked her to tell Per that we had managed to reach an agreement with the “southerners” and requested an invitation to Norway.

The Norwegians did not stop working on the project. Per H. Christensen was confident that we would achieve a result; he, like our General, was already living the project. His entire team worked together diligently and persistently. Of course, the approaches to development were different. For them, manufacturing started from scratch. “Kvaerner Moss Technology” only produced general views, while detailed drawings were developed at the manufacturing plants. There was no experimental testing. Specialized organizations were involved for stability and strength calculations.

—How are things?—Per was proud of these Russian words.

—Things are fine,—I replied.

—Did you manage to persuade “Yuzhnoye”?

—Seems so. We worked seriously and found a solution.

I handed him the meeting protocol. Irina immediately translated everything into

English for him. Per carefully studied all the figures. I watched him. There was no reaction on Per's face.

—I thought you'd be happy that we found a solution to this problem.—Per remained silent.

—Is something wrong? We stayed within the limits.

—But you excluded the cost of manufacturing the launch vehicle and the block.

—And that's what we couldn't manage.

The limits imposed put us in a disadvantageous position. The Westerners' tactic was to first suppress, then release a little. From Per's face, it became clear that he would back down.

—Per, you yourself understand how difficult it was for us to reach an agreement.

—I understand, but I cannot accept your figures. I need to consult with Boeing.

To myself, I thought: “You are too cunning. When it comes to the platform, its price grows faster than an icicle on a roof, and here you start playing the savior of the topic.” One had to know Per. He sat thoughtfully. It seemed as if a computer was working in his head. He was calculating various options, and for him, a good player, it would be unnatural to give up just like that. Per continued our conversation as if he had already spoken with Boeing:

—A solution can be found. But the first rocket must have half

the cost.

—I also need to consult. You've already cut us to the bone. But Per was already "in the saddle."

He started talking again about political instability, about the project paying off after several years of operation, how difficult it was to persuade insurers and investors. From his tone, I understood that he would not back down from the price of the rocket for the first launch.

—I'll call the General. I can't decide such a matter without him.

Per looked at me somewhat cunningly. It was a reminder of our disputes over the limits. His gaze seemed to say: "You're counting our money again."

I called the General.

—Well, how are things?

—Fifty percent. The summary was accepted, but only half the cost was added for the first rocket. We need your approval.

—We have no choice. We must agree. We need to get a foothold in the project; we cannot lose it.

—Alright, I'll convey your agreement.

Per received this message as a matter of course.

Another plane, again snow-covered Moscow.

—We need to prepare for a meeting with L. D. Kuchma. Stanislav Nikolaevich has started to waver again. Without the support of the President of Ukraine, this will drag on for a long time. I received excerpts from the American press. Again, separate negotiations about using the Ukrainian launch vehicle,—the General greeted me with these words.

I reported in detail about the meeting in Oslo and said that the Norwegians also expressed concerns about this.

—So we'll go. I asked V. P. Horbulin to organize the meeting. The meeting will take place in February 1995. Prepare the talking points for the meeting. The meeting will be short, so we need to prepare very thoroughly.

—Yu. N. Koptev found out about our trip,—Yuri Pavlovich continued,—and will go with us.

—But he completely ignores our project. Is he our helper or our opponent?

—We cannot do without the Russian Space Agency. The project has state support; we will have to obtain various permits many times, and a license too. We cannot do without Yu. N. Koptev. And finally, we need to decide that the Zenit launch vehicle is a Russian-Ukrainian rocket.

The flight was included in the plan.

Ukraine was building its independence, just like Russia. Its own

president, its own parliament, customs, etc.

The country's President had enough concerns without us. A ruined economy, national issues—all of this was his top priority. And yet, he found time to meet with us.

The entrance to the presidential palace, if it could be called that, was very simple. So it seemed to us. Perhaps because we were looked after by his security assistant, our old friend, V. P. Horbulin. He met us in his office. I completely forgot to mention that the Norwegians also flew with us for this meeting: Per H. Christensen, Diderik Schnitler, and, of course, Irina. They explained their desire by saying that they wanted to personally convince the President of the good start of the Sea Launch project. In Vladimir Pavlovich's office, we exchanged opinions on the exclusivity of the Zenit rocket.

He was categorically against transferring exclusivity, to which he received a detailed explanation from Per H. Christensen that the project could not proceed without it. An understanding was reached, but, of course, the final decision rested with the President.

We were invited into the office for a meeting with the President. It turned out to be very close. True, we had to pass a security checkpoint. We entered the hall. A large table, beautifully decorated with flowers. The spotlights came on, cameras clicked. The President entered. It was somehow hard to believe that this was the former lead designer of Yuzhnoye Design Bureau entering the meeting hall accompanied by his assistants. The President warmly greeted everyone. He didn't forget anyone, saying a few words to each. It seemed that he had become himself again, had gone back to the past, and nostalgia appeared in his eyes. But this was a momentary delusion; then Leonid Danilovich returned to his "presidency." He sat at the table opposite us:

—I was told about the purpose of your visit. I believe that we should move forward together in the rocket field.

—Absolutely,—Yu. N. Koptev interjected,—we very much hope for fruitful cooperation. After all, Russia and Ukraine are a single mechanism. Take the Zenit rocket, for example: your factory manufactures it, but more than 50% of the components are supplied by Russia.

—Yes, the Zenit rocket is a good rocket. I remember well how we mastered it. Today, it is the best rocket.

Yu. P. Semenov joined the conversation:

—We must preserve this rocket. We propose to use it in the ISS "Alpha" and the "Sea Launch" project. Today, it's no secret that the Russian Ministry of Defense has already switched to other launch vehicles: "Proton," "Soyuz." The project for a purely Russian rocket, "Angara," is already being considered. But in a project, say, "Sea

Launch,” when the rocket was chosen, I, as the General Designer, stood by “Zenit.” This is understandable. It’s an environmentally friendly rocket, unlike “Proton.” Equipment from the latest years of development, high operational characteristics—all this speaks in favor of “Zenit.” After all, with “Zenit,” we achieve the same payload capacity to geostationary orbit, when launched from the equator, as “Proton” provides from Baikonur.

—That’s very good. We support this proposal. I have been briefed on the Sea Launch project. I approve of the participation of both Yuzhnoye Design Bureau and Yuzhmashzavod in this Company and project. Ukraine will not let you down. Right, Yuri Sergeevich? —L. D. Kuchma addressed the plant director Yu. S. Alekseev, his successor in this position.

—Of course, Leonid Danilovich, we will not let you down, we will make as many rockets as needed.

—I have no doubt.

—Mr. President,—Per H. Christensen addressed Kuchma in his soft and cunning manner,—the largest Western firms will participate in the Company. These are, first and foremost, the world-renowned Boeing and Kvaerner from Norway. Together with RSC Energia and NPO Yuzhnoye, I am confident that we will achieve our goal.

Then he did not miss the opportunity and briefly told the President about his firm and that, if necessary, they were ready to work on other projects with Ukrainian enterprises.

—The most important thing,—Yu. P. Semenov took the floor again,—is that we risk nothing. Today, Boeing and Kvaerner have taken on a great risk, but they must have guarantees and support from our enterprises on the part of governments and presidents. If this does not happen, it will cause great concern among partners. Boris Nikolaevich Yeltsin and Viktor Stepanovich Chernomyrdin supported this project.

—We also supported it,—L. D. Kuchma quickly reacted.

Everyone at the table became animated. Our time was up. The President stood up, said a warm goodbye.

We went to V. P. Horbulin’s office. Any trip must end with a document. It was here, in Vladimir Pavlovich’s office, that a document was signed at the level of space agencies on cooperation and the issuance of permission for the exclusive use of the Zenit rocket.

We returned to Moscow late. Everyone felt that a very important step forward had been made on the project. Now the behind-the-scenes talks about the status of the Zenit launch vehicle

were over. Participation in the Company promised up to 75 orders for the Zenit launch vehicle over 15 years, which means employment for hundreds of people. The President of Ukraine understood this well. His position also gave a good impetus to the formation of the position of the General Director of the RSA, Yu. N. Koptev. Formally, the Sea Launch project was not part of Russia's federal space program. The RSA's position at that time looked something like this: "You play around, play around, nothing will come of it without us anyway."

This disbelief in the project by the RSA leadership was also transmitted to its employees. When visiting the RSA, one of its employees would invariably make a sarcastic remark to me about it. And this trip to Ukraine was, perhaps, decisive. Our foreign partners now had guarantees not only from the leadership of Russia but also from Ukraine.

SEA LAUNCH COMPANY

The project development proceeded as usual. Without waiting for funding, we finalized the cooperation. We did not want to have intermediaries in technical matters. The strategy of our enterprise was that RSC Energia took on the leading role in project development. Our co-contractors, who were developing ground systems, also asked us to do this. They really did not want, for example, KBTM to be the lead for the ground segment. This would mean extra money, and most importantly, a loss of development time.

Implementing this strategy, the lead design bureau's division prepared technical specifications for all co-contractors, numbering over two dozen, and in addition, it was also necessary to issue specific initial data for each system and define the interface issues of the complex. This enormous work was carried out by the project department and the ground system specialists.

How many times have I seen rocket launches, their mesmerizing flight is visible for only a few minutes. These minutes concentrate the energy and labor of thousands of teams, in these minutes there is hope for success, doubt whether everything was done correctly, in these minutes there is faith in the Almighty, and a plea for good fortune. And how much needs to be done for IT to take flight. Hundreds of people cherish it, nurture it, God forbid that an error should creep in at the last moment, and then in fractions of a second, enormous labor will be turned to dust.

Success is laid at the earliest stage, at the stage of issuing necessary data to co-contractors. The performer must possess outstanding knowledge not only of their own system but also a good understanding of interface issues and the needs of neighboring systems. It is at the interfaces of systems that possible errors are "buried." It would seem like a small rocket, but it requires enormous ground preparation. Not a dozen ground co-contractors are involved in this process. Take, for example, the gas supply system. This is an entire complex of tanks and units. Our project envisioned over four hundred high-pressure cylinders alone. And this is with a pressure of about four hundred atmospheres in them. From these, high-pressure gas flows into the control elements of various reducers and valves of ground systems, thereby ensuring the control of many critical elements.

Our co-contractor from Kovrov, the enterprise of Yu. L. Arzumov, was responsible for the development of the fittings for

this system. A small enterprise with good traditions and, undoubtedly, a friendly and business-like team.

Rocket launches, which were typically designed for the tasks of the Ministry of Defense, must take place under various weather conditions, meaning both in heat and in severe frost. Rocket systems must be protected from unnecessary stress. For this, a thermostatic system is created. It maintains a temperature regime on the rocket that would be comfortable for the rocket's units. Compressors, refrigeration units, air conditioners are installed, pipes are routed, and all of this is equipped with automation. All of this is done for the sake of other systems. Some need more heat, others more cold, and still others need a stable temperature. Therefore, before the performer of this system, all conditions that the created thermostatic system must satisfy need to be stipulated.

Using these two ground systems as an example, I wanted to show how knowledgeable the person who sets the requirements for the systems must be. It is enough to omit something, and the complex mechanism will break down.

I won't mention that all systems are powered by electricity and each requires a specific voltage and frequency. It seems simple when you lay it all out. But arranging these shelves correctly to create an ensemble is a task of a higher order.

This is the enormous work our specialists carried out in the first half of 1995. Good relations with co-contractors allowed these works to proceed without funding. We explained that a Company would be created any moment, and then...

Our foreign partners were not in a great hurry to finance the work. However, credit must be given to Boeing for also launching marketing efforts. In our simplicity, we thought that once the Company was created, Boeing's and Kvaerner's money would start working for the project. Only later, with our socialist mindset, did we realize that they had no free money; they borrowed money from banks under guarantees from either customers or governments or other sources. That's why Boeing launched its marketing efforts. It reached an agreement with the American company Hughes that their satellites would be adapted to the Zenit rocket; preliminary contracts were agreed upon.

Something was holding back the creation of the Company. But what? We couldn't understand. It had already been agreed that the Company would be registered in the Cayman Islands. The Cayman Islands were not chosen by chance. Taxes there were minimal. Time passed. I called Oslo, but the matter didn't clear up. Per said that everything was going normally, but from his tone, one could guess that he was also nervous.

The bureaucracy in the USA was even worse than our socialist one. It was necessary to obtain permission for technical cooperation, permission to join the Company, and a bunch of other various permits and licenses. Navigating government corridors required enormous effort. All permits were obtained in six months at best. When we “teased” the Americans that their democracy was bureaucracy, they readily agreed with us.

In April, finally, we received the necessary call that we needed to meet and finalize the terms and sign the agreement. At last.

The General convenes the cooperation board:

— A crucial moment is approaching. We have come to the creation of the Sea Launch company. I want to say right away that the project is complex, perhaps not entirely profitable for us. But it is an avant-garde project. I believe this is a new marvel in rocket technology. It gives us work, employment. Today, we are faced with harsh conditions. Not only will we have to manufacture upper stages at cost, and the first one at half price, but I believe this is temporary. Today, Boeing’s project orders are about a billion, and after covering the creation costs, it will give us additional profit. I would like to hear everyone’s opinion — are we going into the project, or are there doubts?

Perhaps for the first time, such a question was posed to the board. I look at the board members. I wonder what they will say now. Many did not believe in the project. In the corridors, they scoffed at it. When I sometimes had to turn to our thematic departments, I would hear words like: “These are the General’s toys, play with him.” I meet the gaze of such leaders. They lower their eyes.

The first to support the project was the plant director A. A. Borisenko:

— For me, this is work, and no one refuses work now. Only, Yuri Pavlovich, I will need the Corporation’s help. You will have to help me from its profits at first.

Following Borisenko A. A.’s speech, everyone eagerly spoke about the interesting project, and it was no big deal that we wouldn’t immediately make a profit; this would be compensated by work, salary, and employment. There was not a single board member who spoke against it. Perhaps many spoke not for the project, but for the General’s position, knowing that he would not tolerate leaders who contradicted him.

— So, everyone has a unified opinion? — Yuri Pavlovich summarized, as if asking and answering. — We fly to Rockwell on April 30th. We’ll discuss the Mir station there, and then to the partners’ meeting. V. P. Legostaev, V. M. Filin, and I are flying.

The meeting ended there.

Before the May holidays, we flew to America. We arrived in Los Angeles. For two days, we were guests of the Rockwell company. We were met by Vice President Bob Miner. He showed us around the buildings, saying that he would soon fly to the launch of another Shuttle. We wrote a brief meeting protocol, and the evening of the next day, we moved to another hotel that Boeing had booked for us. This two-story hotel was located on the picturesque Pacific coast. A surprise awaited us in the lobby. S. N. Konyukhov, Yu. S. Alekseev, V. G. Komanov, and their accompanying specialists were sitting at coffee tables.

— Hello, “Muscovites,” — Yu. S. Alekseev jokes.

— Our regards to independent Ukraine, — Yuri Pavlovich replies in kind.

— And do you know what day it is today? Today is International Workers’ Day. Our holiday.

— This must be celebrated, — S. N. Konyukhov supported, — we cannot break traditions. We’ll do without a demonstration, but we must celebrate our holiday.

They accommodated us in a small hotel. Each had their own room. Beyond the dam, the ocean roared. There was no hustle and bustle in the hotel. It seemed as if no one lived there. Only at breakfast could one discover that this was not the case. And the full parking lot also indicated the same.

In the evening, P. Inyart appeared. We understood that he was responsible at Boeing not only for economic issues but also for organizational ones. He announced our program:

— Tomorrow we visit Hughes. We’ll make a presentation there, then fly to San Jose, and from there to Seattle. We are on the eve of signing the agreement. And the customers want to get acquainted with us. Or rather, we want them to get acquainted with us, to be convinced of the seriousness of our undertaking.

The program, agreed upon earlier, was accepted, and in the morning, after putting us in rental cars, they drove us to the Hughes company.

The access control system was somewhat reminiscent of ours, only the guards were smiling and polite. Photography was not allowed.

The meeting room, we had seen such rooms many times, was for some reason without windows, well-equipped with apparatus, and quite spacious. In the corner, tea, coffee, cookies. The atmosphere was relaxed.

The presentation was given by R. Olson, who was responsible for this project at Boeing. He focused on the composition of the Sea

Launch assets, its technical characteristics, and readiness dates. Everything was listened to carefully. There were few questions. A break was announced, and then one could notice the activity shown by both R. Olson and P. Inyart. They convincingly argued something to the Hughes employees, and it seemed to us that they nodded in agreement. They offered to visit the production facility. We walked along the cleanest corridors. Through a large glass, they showed the assembly shop. Unhurried work was underway on one of the spacecraft. Workers in overalls and, of course, with "Hughes" written on their backs. They explained that the company had already launched dozens of its spacecraft, and all of them were successfully functioning in orbit.



Leadership of Energia and Yuzhnoye in America. S. Komanov, V. Degtyarev, Yu. Alekseev, S. Konyukhov, Yu. Semenov, V. Filin, V. Legostaev

We moved to the control room. The wall of TV screens was striking. There were 70 of them, and they glowed with all the colors of the rainbow. Each screen — its own program. They explained that each screen was a separate commercial service, whether for a private company or a state one. They served the whole world, and the control position was displayed here, in the Hughes center. Behind a transparent partition sat operators who monitored the work of the satellites.

We moved to another hall, also with many screens, also with operators, but their task was different: to monitor the state of the satellites themselves, that is, the temperature regime, orbital position, and energy. Via the command radio link, they could make adjustments to the operation of the service systems and the orbital

position.

The tour was short; we returned to the meeting room and thanked them for what they had shown. In response, we heard that they were ready for cooperation. This was the main thing.

Another car, we rush to the airfield. The cars are immediately returned. A plane, and we are in San Jose. We rent cars, and now we are at the Loral company.

Again a meeting room, a presentation. Again the same procedures, again we heard the necessary words about readiness for cooperation, and quickly to the airport. In the evening we were already in Seattle. It was a stressful day. In the morning, our General gathered everyone in the hotel:

— Let's agree on the spot before we go to the meeting. We need to be united.

— Agreed, — S. N. Konyukhov quickly replied, — only in the agreement, it should be noted that we conduct launches under the Globalstar program outside the Company.

— And why?

— We have gone too far. We have bound ourselves by certain obligations.

— But it would probably be more profitable to do it within the Company.

— We cannot break our promises.

Of course, there was a certain attitude from our Ukrainian partners. In Soviet times, when Generals were respected, when they could freely address the head of state, when technical policy was paramount to economics, and sometimes even evolved into a political direction, the General possessed immense power. In our project, he became one of the partners. This, of course, hurt his pride, and overcoming himself was a difficult task.

— We need to find a compromise, — Yuri Sergeevich Alekseev interjected, and as if everyone agreed with his thought, he immediately continued, — I have several comments on the draft agreement, or rather, questions.

— First, we are committing to a fixed price, although there is inflation for both the ruble and the dollar. And second, the issue of the rocket's cost itself needs to be resolved.

— Let's agree that the fixed price and the price of the rocket and the upper stage will only be for a certain batch, and then a review of obligations is necessary. Regarding launches with Globalstar: let's come up with a proposal for a limited number of them. How many launches did you commit to?

— Three for now.

— Let's propose that to our partners.

They discussed a number of other comments on the agreement. Alexander Viktorovich Degtyarev was particularly diligent. Apparently, guessing the General's mood, he wanted to earn his "points." Finally, everything was agreed upon, and we moved to the meeting room. The events unfolded on the sixteenth floor of the hotel.

— Everything is ready for signing, — Per and D. Nablit greeted us.

Dimmed light over the table. Five copies of the agreement and five solid gilded fountain pens lay there. Our foreign colleagues were dressed, as they say, to the nines. The solemn moment had arrived, in their opinion.

It was nearing noon.

— Before sitting down at the table, we also used your tactic. Today we gathered and discussed the agreement. We jointly have a number of questions. They need to be discussed, — Yuri Pavlovich began this meeting.

P. Kristensen, D. Schnitler, D. Nablit, and R. Olson's faces showed bewilderment and even irritation.

This was especially noticeable with Per. He was one of the main ideologists of this document. As he told us, he defended the interests of the Europeans, and then this happened.

— We have discussed everything, and more than once.

— Let's still listen to the Russians' questions, — D. Nablit agreed.

— The first and most serious question is to give Ukraine permission to conduct three launches under the Globalstar program outside the Sea Launch company.

— How can this be? After all, exclusivity is given to the Company, and no commercial launches can take place outside of it — this is our strict rule, — D. Nablit replied.

— Before the Company was created, we independently sought partners and signed documents with them. We cannot violate them. After this, we will not be trusted.

— And why don't you want to conduct the Globalstar launches under the auspices of our Company? I think you will get what you want, and the Company will be profitable, — Per asked.

— We have gone too far. It is impossible now.

— But you must also understand that it is impossible without exclusivity.

— We are only asking for three launches.

The conversation turned into an endless argument, and the longer it went on, the more stubborn S. N. Konyukhov became, and the more irritated the foreign partners were. To defuse the

situation, Yu. P. Semenov suggested discussing other issues. There were about twenty of them.

From a tense atmosphere, it became a working one. We moved forward slowly, but gradually found mutually agreeable formulations. Credit must be given to both the Norwegians and the Americans for the patience with which they sometimes had to explain the laws of the market to us. Gradually, their patience came to an end. A. V. Degtyarev from Yuzhnoye Design Bureau particularly irritated them. Around 11 p.m., D. Nablit suggested taking a break for dinner, which had been waiting for us on the 26th floor of the hotel since 5 p.m.

Hungry and a little agitated, we ascended in the luxurious elevators to the restaurant. The maître d'hôtel very kindly greeted the last visitors. Friendly waitresses invited us to the table, as if it were not midnight, but the very 5 p.m. for which dinner had been ordered. At the table, silence reigned at first, only individual remarks about the good project and what a pity it would be if it fell apart were heard.

Apparently, after conferring among themselves, the Americans and Norwegians agreed to give these three launches to Ukraine, but they looked at us and expected S. N. Konyukhov to retract his words. He remained silent. Yu. P. Semenov also remained silent. Finally, D. Nablit could not bear it:

— All right, we will give you these three Zenit launches with Globalstar satellites, but no more!

Apparently, he had already reported to the management that everything was in order, that the agreement was ready, or perhaps he had simply consulted.

— But keep in mind, we will not make any more concessions.

A buzz of excitement filled the table, as if a heavy burden had been lifted from their shoulders.

They took out the agreement and immediately began signing it at the table, adding a small handwritten appendix on the discussed issues. A. V. Degtyarev popped up again: "I have comments." D. Nablit couldn't take it, snatched the agreement from his hands, and, in my opinion, was ready to hit Alexander with it, and as if addressing everyone, said:

— If there are any more ridiculous questions and outbursts, we are leaving.

— Calm down, Sasha, — S. N. Konyukhov said. Everyone fell silent.

Per, who had prudently taken the gilded fountain pens, distributed them to the top officials. The signing took place. They began taking pictures, talking about the historic moment,

swearing love and friendship. In general, a normal process of “relaxation” began after a very difficult day.

Thus, in Seattle on May 5, 1995, one of the most important events of the year, and perhaps of the century, took place: without governments, the companies themselves, known in their countries as the main creators of aircraft, rockets, and ships, united to implement commercial spacecraft launches into a company with the beautiful name Sea Launch.



Sea Launch Project Partners. A. Eshpi, S. Konyukhov. D. Opbou, Yu. Semenov. Yu. Alekseev. P. Kristensen

INSPECTION

— What do you think of R. Olson? — V. P. Legostaev asked me after the signing.

— He's fine. What's the matter?

— Boeing is proposing him as president of the company.

— And is Yuri Pavlovich agreeable?

— Yes, he agrees. He asked for your opinion.

— And what do you think my opinion is?

He laughed:

— I was just following the General's instructions, that's why I asked.

— And do the Norwegians agree?

— But he is R. Olson.

We both laughed. Ron Olson from Seattle became the first president of Sea Launch. We flew to Moscow, and the Ukrainians flew to Kyiv.

The flight from Russia to America is very difficult. It lasts 10-11 hours and takes place during daylight hours. But the return flight is even harder. We arrived in Moscow in the morning after flying all night. On the plane, the General warned:

— Tomorrow, gather everyone involved in the project at my office. I will listen to reports on what has been done. The agreement has been signed. Everyone must understand that these are not games. We must fulfill our obligations. I will personally oversee the progress of the work.

Little good could be expected from such words. So, directly from the plane, I went to the enterprise. I gathered all the managers. I briefly spoke about the trip. I started reviewing the materials. A certain amount of work had already been done on each system. The initial data, technical specifications, and system composition had already been determined. We agreed on how to present the report. Tired, or rather exhausted from the flight and the debriefing, I simply collapsed onto the bed at home.

In the morning, a meeting. The General asks:

— Who will report?

— Each on their own system.

— Good. Who's first?

V. N. Bodunkov stood up:

— I will report on the gas supply system.

— Where is the poster?

— ?

— I'm asking, where is the poster? — the General grew increasingly irritated.

— We issued the technical specifications to the Armatura Design Bureau (Kovrov), provided the initial data, and fully defined the system's composition.

— Where is the poster? Can I see all this on a poster?

— We have all of this printed out. Here, take a look.

— I won't look at anything. You are not ready. Who's next?

M. V. Likhachev stood up to report on the fueling systems.

— Are you also without a poster?

— We made them in a small scale.

— Can I see them?

Mikhail pulled out small-format sheets.

— I don't see anything. These are not posters. Not ready. Sit down. I want to warn you that I am taking all work under my personal control. To start, I am depriving the managers of their salary bonuses. I expect reports as required in a day. When we were building the orbital ship and commissioning the MIC, everything was detailed down to the smallest detail, and everyone kept daily control on posters, and it was visible on the posters what was being done. Everyone is dismissed.

They started to disperse.

— Well, well! — I thought.

No one expected such a turn of events. It was clear that the style and manner of work needed to be adjusted to the General.

Sometimes it was unclear how my colleagues in the manned space program worked with the General. They would run to him to consult on every trifle, and God forbid if something was corrected after his advice, even if the technical proposal was not entirely rational. But expressing one's opinion to the General was dangerous.

A leader is also a human being. And it is human nature to make mistakes. But a good leader admits their mistakes and corrects them. Making a particular decision is related to the information possessed by the decision-maker. Mistakes arise because the amount of information at the time of decision-making was small. Therefore, to the credit of our leaders, it must be said that they did not rush their decisions but thoroughly studied the issue. It is not for nothing that the Russian proverb says: "Morning is wiser than evening." This means that additional information may appear in the morning that can make adjustments to a particular decision.

In this case, I understood that the General did not have information about the work. I realized my fault for not reporting often, for not consulting. When working with previous

management, only strategic decisions were reported, and advice was sought on courses of action. Here the style was different. It had to be accepted as a given. I was left with a feeling of guilt towards my own people.

After the meeting, I went to the General's office. It was as if we hadn't flown together for 10 hours.

— May I report?

— I have nothing to report. You are personally responsible for this area. Keep that in mind!

— I don't want to make excuses, but a lot has been done, and the posters will be ready by Friday.

— We'll see then.

The General called V. P. Legostaev:

— Viktor, please check if everything has been issued and what has been done.

— Alright, it will be done by Friday.

— If you want to punish, then punish me, — I addressed the General, — it means I didn't organize and demand, and punishing my subordinates for not being prepared for the report is harsh.



M. I. Stepanov, V. N. Bodunkov, M. V. Likhachev

— They are not boys. They should understand that this is a serious matter and the demand from you and from them will be the strictest.

— Today is V. N. Bodunkov's sixtieth birthday, and instead of a gift, he received a removal of his bonus.

— We will not punish V. N. Bodunkov, — Yu. P. softened.

— Leave only me in the order,

— I repeated my request.

— We'll see on Friday, — the General avoided the conversation.

Knowing the General's character, I thought that the "storm" had passed. By Friday, we would do everything the General

required. And then we would see. The leadership had a forgiving nature. Two days, the departments worked until midnight, and although all the information was already on the computer, there weren't enough plotters to display it on posters. Many had to do it the old-fashioned way: writing the system composition in large letters with markers on the back of graph paper, marking the issuance of technical specifications, initial data, and the approval of these documents by co-contractors.

The picture was shaping up nicely. Thanks to the personal connections established during the creation of "Energia-Buran," the co-contractors were already involved in our work, for which we had only promised payment.

On Friday, the entire office was covered with posters. Reports were not required: everything was visible on the wall.

— I see you've worked, — the General assessed.

— What do you say, Viktor?

— Yes, Yuri Pavlovich, I checked all the technical specifications, the initial data has been issued, and practically everything has been approved.

I listened to this message with satisfaction. V. P. Legostaev was involved in the development of control systems. Erudite, one of the leading specialists in his field, he possessed good logical thinking. He approached all issues from a systemic perspective. So it was in our case — he laid out the entire "solitaire" for all systems. He did not contact me but worked with the performers. So the picture reported to the General turned out to be objective. After the meeting, everyone dispersed. V. P. Legostaev and I remained in the office.



Viktor Pavlovich Legostaev

— I see a lot has been done. But you must understand how seriously we've gotten into this project. I won't let anyone fail it. Do you understand me?

— I understand.

— I'll hold off on the order for now. But watch out!

— R. Olson is coming. He wants to see how our work is progressing, — says Legostaev V. P.

— It would be better if he transferred the money. We only promise to pay everyone. Prices are rising, and tomorrow there might not be enough allocated funds, — I interjected.

— Ron wants us to show him our main co-contractors, — V. P. Legostaev continued.

— We need to show them, — Yu. P. agreed, — just warn the bosses, let them prepare for the meeting. At least clean up. Write out the program, call everyone, and agree on the visit date.

— The co-contractors are not only in Moscow. And we have no more than five days allotted.

— You'll take a plane, — the General allowed, — I'll give you A. L. Martynovsky's team.

And so it was decided.

To show the President of Sea Launch that a lot has been done means he will understand that payment can be delayed. To say that we have done nothing because there is no money is also impossible. This means that our work is not underway. We needed to find, as they say, the golden mean. I had to talk to all the directors. We agreed to show only the design phase of the work, and then a halt — funds were needed.

First, we visited Dnepropetrovsk. We stayed there overnight.

The huge factory was operating at 30-40% of its capacity. Rocket production, as they say, was barely flickering. There were practically no orders. But all the technological equipment, the control and testing station, were in ideal condition.

We went further through the mechanical workshops. At the machines — metal shavings. The Americans exchanged glances, pointing to the shavings with their eyes. It was clear that they saw working machines. The chief engineer Sichevoy V. I. accompanied us through the workshops; he spoke about the factory with such love that it was immediately clear he was a patriot of his enterprise. In the evening, a traditional dinner with horilka, salo, and an abundance of various food.

In the morning, we flew to Rostov-on-Don. The small enterprise "Iris" was on the verge of collapse. They were developing launch control panels for us. They hadn't received money for a long time, but they were working on our project. The inspection took about two hours. Then, lunch in the director's office, Russian style. Our guys had to organize even this. There was no money even for lunch for the guests.

A plane — and we are already in Voronezh at the mechanical plant. They make the engine for the upper stage. Once, this engine was developed by our design bureau, and manufactured by our plant, and then the rocket engine was transferred to series production in Voronezh. The plant is powerful with good traditions.

We walked through the workshops. The director of VMZ, A. I. Chasovskikh, accompanied us. He was probably the youngest director in Russia commanding such a giant factory. It seemed that our foreign colleagues found everything to be a marvel. It seemed

they were not sure that we could create such complex technology. And here, in the factory workshops, one could see fantastic products with their own eyes.

Again: Russian lunch, plane, Moscow.

In the morning, we set off for Kovrov to Yu. A. Arzumanov (Armatura Design Bureau). The new Ford minibus sped along the highway. It's good when you drive for an hour, maybe two. But here it was four.

— And what, don't you have small airports, — asked R. Olson, — a lot of time is lost on the road.

— We don't have developed small aviation. It's mainly used in the periphery. And here, near Moscow, there's no need.

— That's bad, — Ron summarized again.

Beyond Vladimir, we were met by the director's Volga. A small enterprise specializing in the production of various fittings. A very interesting tour of the enterprise. Usually, they start with metal, casting, mechanics. But here, they immediately took us to the assembly shop. Cleanliness, separate cabins for assembling fittings. There were also test stands, and they even started showing the entire technological cycle of manufacturing. Again, it impressed the Americans. They asked roughly the same questions everywhere.

— Do they know what needs to be done for the project, what the deadlines are, and do they have all the initial data?

The answers were satisfactory, and everywhere it was stated that funds were already needed.

We had lunch, or rather, dinner immediately, in a small cozy cafe. Of course, Russian vodka was not absent. It's just how it is with us, if there's a guest, there's always a bottle on the table. The Americans were surprised at first, but then they got used to it, only saying: "Oh, my liver," but they drank no worse than us. The return journey was shorter. After a hearty meal, a sleepy atmosphere reigned in the minibus.

In the morning, another plane. To the Urals, to Nizhny Tagil. We landed at one of the military airfields. What immediately struck us was that hundreds of MiG fighters were parked, all covered. The airfield seemed to be asleep. At the gangway, the general director of Uralkriogenmash, Zashlyapin R. A., met us with his deputy Cheremnykh O. Ya.

— Welcome, safe arrival.

To our surprised glances towards the parked planes, he replied:

— We are withdrawing troops from Germany.

— And what will happen to them (the planes) next?

— Who knows.

— Will they really be written off, cut up, and that's it? They

could be sold.

— Probably.

The conversations ended there.

The road to the enterprise was short. We drove past huge factory buildings.

— It's standing idle, no orders. And what tanks were made here! Now no one needs them, — explained Rudolf Alexandrovich Zashlyapin.

“Uralkriogenmash,” compared to the tank factory, seemed tiny. But the huge cryogenic tanks on railway trolleys told a different story. The tanks were not standard railway cisterns, but about one and a half times longer. They incorporated the maximum dimensions allowed by the railway. From marking to automatic welding — everything was done here. The necessary control was also done here. We planned to use these tanks as ground storage for rocket fuels.

Everything was liked. Lunch again. Exchange of souvenirs and — to the plane. The prolonged lunch prevented us from arriving at the appointed time. Our commander V. I. Pyatkin was nervously pacing by the plane.

— Are we not late?

— You can take your time. They won't give us clearance for takeoff!

— How? Why?

— It's already getting dark, and it's a daytime airfield. It's not equipped with lighting.

— What to do?

— We need to persuade the dispatcher.

— Listen, Rudolf, as the General, can you talk to them?

— I'll try.

Time was not on our side. Five minutes later, Rudolf Alexandrovich returned.

— They will give clearance for takeoff under your responsibility, they are calling the commander. V. I. Pyatkin rushed to the airport terminal.

— To the plane! Takeoff granted.

The commander's worries were related to the fact that he was scheduled for a flight with the General the next day. A disrupted flight with the General could lead to complications. We taxied onto the runway. Practically without stopping, we began our takeoff roll. I stood in the cockpit. The situation was calm. We lifted off, and a few minutes later, darkness fell. We couldn't keep up with the sun. Drops of sweat on the commander's face indicated that the takeoff had not been easy.

I entered the cabin.

— Is everything alright? — and as if answering himself, Ron said they had no doubts.

— Neither did we, — I replied, though wiping my damp face. That takeoff remained in my memory for a long time.

It remained to inspect the enterprises of Moscow. We visited “Kriogenmash.” Its director, V. E. Kurtashin, was a little displeased that large tanks had been given to the Urals. When choosing who would do it, the price was the deciding factor. This was reminded to V. E. Kurtashin.

— We will show you the production and I want to assure you that we have never let anyone down.

We walked through the factory. There was a sense of life in the workshops. We went into the museum. O. P. Litovka showed working diagrams.

Well, I thought, it has begun. Our people didn’t warn us. As it turned out later, they did warn us, but the cryogenics specialists had a different tactic. They wanted to take on all the cryogenics and fueling system themselves. So they showed that they had gone far ahead.

— This is good, — Per Christensen summarized. He arrived in Moscow late and only joined us on the fourth day.

— We thought that everyone’s work had progressed so far.

The fact that everyone had advanced far in their developments did not cause me any doubts. But inside, anger was brewing towards our partners — after all, there was no money, but they demanded work. Therefore, we faced a dilemma: to say that we had done a lot would be perceived as if we were worthless, that we could work for free; to say that we were not working was also impossible, because we were the initiators of the project and had to be ahead in developments. So we had to maneuver between two fires.

At KBTHM, M. I. Stepanov’s affairs were no worse. A small design bureau, which was engaged in the development of the fueling system for components and compressed gases for the DM block, was located in Moscow. The visit to this enterprise caused some satisfaction among the Americans. All systems were simply replicated from already proven ground systems used at Baikonur. Mikhail Ivanovich personally walked through the small workshops and clearly explained that he had no problems with the systems, there was only one problem — to create a production reserve, and for that, money was needed.

A small lunch, and we moved to RNII KP. The enterprise was in a distressed state. The workshops were not working. Silence at the

factory. E. N. Galin explained for a long time what they were doing, that the radio control, management, and communication system was in their hands, that they would not let us down, and even found a practically ready antenna that could be installed on the assembly and command vessel.

The partners, like a sponge, absorbed information. It was not often that a smirk could be seen on R. Olson's face.

Organizing visits to many enterprises, once closed, in such a short time was not an easy task. We explained to the partners that the visit to NPO Avtomatiki i Priborov would be very limited, which was also accepted with understanding. V. V. Morozov simply spoke about the principles of building the control system and its operational features.

The next day, a trip to the Transport Machine-Building Design Bureau to G. P. Biryukov was planned. We were met in a newly equipped negotiation room. R. Olson and Per H. Christensen were in an aggressive mood.

The fact was that our organization took on the leading role for the launch complex, leaving KBTM only what the organization itself was directly involved in. The coordination of all systems involved in the launch was taken on by our 6th department, led by V. N. Bodunkov. A conflict was brewing. It came to mutual grievances. G. P. Biryukov, secretly from us, approached our partners before the meeting, where he said that RKK Energia was not capable of doing such work. He was strongly supported by the General of KB Yuzhnoye, S. N. Konyukhov. Everyone was fighting for their jobs.



At KBTHM

There was no shortage of pride and struggle for their work. Some leaders felt “great” and didn’t even take jokes. Sometimes you look at such people and wonder how they could have risen to leadership positions? A lack of logical thinking, constant boasting. By showing their importance, they don’t realize that they look ridiculous in the eyes of people who have already learned their true worth. But for a newcomer, it looks impressive.

The business conversation at KBTM did not work out. Instead of talking about the progress of work on the launch table, cable mast, and launch pad cooling, they started talking about how RKK Energia underestimated them, that the project simply could not happen without them, that only they comprehensively understood all aspects of rocket launches, and they spoke with complete enthusiasm about their automatic launch of “Zenit.”

At first, I didn’t even understand what automatic launch they were talking about. After all, back in the time of S. P. Korolev, our organization designed, developed, and tested a completely unmanned launch for a combat missile. I also remembered our Energia rocket, where the launch was also unmanned; everyone was in a bunker several kilometers from the “zero” pad (as the rocket launch site was called). And here, they spoke with such enthusiasm about automatic launch that sometimes you envy how many epithets can be uttered about what seems to be an insignificant matter.

But this is also an art: to show your work. Even if it is not voluminous, small, but the feeling of pride in it overwhelmed our co-contractors.

The guests’ mood was unclear. They liked that there were disagreements within the “Russian” camp. This only played into their hands. They could use this to negotiate a lower price for the work. And right there at the meeting, representatives of KBTM raised the issue of a direct contract and direct payment for their work.

— I think we’ve gone in the wrong direction. We came to discuss and listen to what has been done, how the work is progressing, — I tried to steer the conversation back to business.

— That’s not the point, — G. P. Biryukov intervened, — the main thing needs to be decided — how we work, and then about the progress of the work.

— I insist on a report on the progress of the work. We gave you the technical specifications, so tell us what has been done.

The foreign partners listened silently to our squabble, with their heads bowed.

A call from the General interrupted our speeches.

— Vyacheslav Mikhailovich, Yuri Pavlovich is interested in how things are going! — I heard the voice of V. P. Legostaev, our vice-president for foreign economic relations, through the receiver.

— Not at all, — I sharply replied into the receiver and, so that our colleagues from KBTM could hear, continued, — instead of a business discussion, there are attacks on our company, saying that we are not behaving correctly, that we will not cope with the leading role, and so on.

— Well, well. Fight, — he said in response.

It was late. Everyone was quite tired.

— I suggest we grab a bite, — the owner of the enterprise offered.

We went into a small adjacent room. The dining table was set, not without vodka, of course. We took plates and shot glasses. Poured, wished each other good health, and split into small groups.

— Don't be angry, — Gennady Pavlovich Biryukov approached me, — you must understand us, we want to work. But working with KB Yuzhnoye, we were the lead for the launch, and we are not satisfied with the role you assign us. And our jobs have decreased because of this.

— That's another matter, — I cut him off. — You just showed that we are not united. Now expect surprises from partners. You should have talked about the progress of the work, and you would have resolved strategic issues with my General.

Inside, everything was boiling. I restrained myself from saying anything harsh. We smiled (probably learned from the Americans).

I approached Irina and Per, and we talked about something insignificant. From Per's expression, I understood that he was biding his time. I wondered what he was planning?

In the morning, a call from the General. From his voice and tone, I understood that I had already been "reported on."

— What's going on with you and G. P. Biryukov? What's the scandal?

— There was no scandal. It just wasn't a businesslike conversation.

— And you are to blame for that, — the General concluded, — do you have any more visits today?

— Yes, the last one is NII Radio.

— Go, then report back.

His tone did not bode well. I immediately remembered Per's face. It was clear there had been a phone conversation, maybe V. P. Legostaev had also reported. I didn't try to analyze the situation. I had other things to worry about.

We went to NII Radio to see Zuborev Yu. B. — former Deputy Minister of Communications of the USSR. We were warmly welcomed, shown the antennas, and reported that there were no problems except financial ones.

All visits were behind us. As was customary for us, after such events, results are usually summarized.

Here it was different.

— I'm flying out tonight, — R. Olson said, addressing me.

— Really?

— Yes. I've already stayed too long.

— Usually, we summarize the results. And it seems to me that you are leaving not entirely satisfied with our work. Tell me honestly. Do you not trust us?

R. Olson lowered his head, lost in thought.

— Do you think we haven't "gotten the work going" yet? — I continued to pester him with my questions.

— Yes, and I'm still not convinced that everything you showed corresponds to reality, that you will do everything. I still have questions.

— Do you doubt our sincerity?

— Both yes and no, — he said with a smile.

— It's a great pity. Even the mere fact that we managed to organize visits to our co-contractors within a week, in my opinion, speaks volumes. A year ago, I couldn't even imagine that such a thing was possible.

— I thank you for these trips. But questions remain.

— I have no doubt. It's just a pity if they relate to our sincerity.

Olson smiled and said nothing.

— As a memento, I want to give you a model of our new development, a Boeing development.

His assistant took a model of a Boeing-777 aircraft from his bag.

— We once had a good wine called Three Sevens, but these are different sevens. Thank you for the gift, — I said.

— This will be the best aircraft in the world.

— I wish you success in that.

— In a week, I suggest we meet in Oslo. Let's see together what has been done there.

— Alright, I'll report to the General.

Shaking hands, we parted.

In the morning, a serious conversation with the General.
Conclusion: you are not a diplomat.

I understood that the process against me had begun. I needed to be careful with my expressions. But there was something else

behind it. I needed to think and think.

The week flew by very quickly. Here we are in Oslo. An office for Sea Launch was rented opposite the Kvaerner office. A beautiful place in the mountains. A delicate bridge now connected the two offices.

The “Sea Launch” office was standard, with separate rooms—offices and a discussion hall. Everyone had their own room, telephone, and other office supplies. A huge shared copier machine.

During this time, we had to finally determine the appearance of the vessels.

To our surprise, the Norwegians had gone far ahead. They had already made drawings and submitted them to the factories. To our questions about how this aligned with the rocket systems, they replied that everything was coordinated based on preliminary data. According to our accepted scheme, drawings were only allowed to be sent to production after the release of a coordination drawing. But here, at their own risk, the Norwegians submitted all drawings to production.

To my surprise, Per demonstratively withdrew from working on the project. He entrusted everything to L. Bjorn.

A. N. Shorin, V. V. Liberman, and the guys from KBOM and KB Yuzhnoye carefully studied the presented drawings. Of course, there were mistakes. Mistakes can be different: some due to insufficient information, others due to incorrect calculations, and still others — intentional. What if it passes? For example, service rooms for fueling devices were included with the launch table.

— That cannot be. A table is a table, and servicing is a function of the platform, — we argued with L. Bjorn.

— I have data from you that the rooms are part of the table.

— Where does that follow from?

L. Bjorn brings a small sheet of paper depicting a plan of the launch device and an adjoining room, designated as “launch table.”

— See here.

— And who signed this? That’s not how we do things. This is not a document.

— But I didn’t write this. It’s written in Russian. So the rooms are part of the table.

We were outraged by this position. After all, this sheet, as we understood, appeared when L. Bjorn was being told about the fundamental design of the launch table, and someone made this inscription not entirely accurately. Now we had to deal with it. The issue was not even that it was technically difficult to do, but that it meant additional money. And neither we nor the Norwegians had it. Usually, when talking about price, a certain composition of

systems and aggregates is implied, which corresponds to the price. And if this understanding is different, then one can argue to exhaustion later.

We went to R. Olson. He listened to us for a long time. But his opinion was on the side of the Norwegians. He also blindly believed that ill-fated piece of paper. We were firm in our stance and insisted on a coordination drawing. We did not receive an answer. It was later that the Norwegians would be given more money and they would incorporate these rooms into their platform project. This is one example of how the work proceeded. But this was a trifle compared to the major blunders. And they also came to light during this meeting.

Together with partners from KB Yuzhnoye (Komanov V. G., Gribachev L. A.), we once again analyzed the technology of installing the rocket on the launch table.

We recalled our arguments about what was better — a tanker or a platform. To the delight of our southern colleagues, we found that when moving the erector with the rocket, the platform sagged significantly, sometimes on one side, sometimes on the other. Simple calculations showed that the rocket's tilt from the vertical could reach an unacceptable value.

We showed the calculations to the Norwegians.

— You are calculating incorrectly. This is a very complex matter. We, shipbuilders, will perform the calculations ourselves, — said Per.

— We may not be shipbuilders and may not understand the intricacies of marine calculations, but a simple approximation indicates an unacceptable platform tilt, — V. V. Liberman objected.

He tried to explain with simple diagrams how he performed the calculations. But it was clear that the Norwegians' pride had been hurt.

— We will look again and give an answer, — said Per.

For two days, the Norwegians did not appear in our office.

— We found a very simple and wonderful solution. We will install two more columns in the area of the table.

— How should I understand that?

— Very simply. We will cut the pontoons. We will insert spacers into them, thereby lengthening them, and place two columns specifically under the table. We recalculated everything again, the platform tilt is within tolerance.

— And how much work?! All of this needs to be redone.

— These are our problems. We contacted the factory in Stavanger. They have already bought the metal and are ready to do this work.

— And how much will this cost, how much will it increase the cost of the platform?

— It's a small amount of money. And we won't miss the deadlines.

— This needs to be reported at the partners' meeting. The issue is very serious.

— I think the partners will understand us, — Per summarized.

— Let's hope so, — said R. Olson, — this is again the cost of the project. We have already exceeded all limits.

— The addition will be small.

So it was decided. The Norwegians (to their credit), without waiting for the partners' decision, urgently redesigned the platform project. Using advanced computer programs, they literally changed the platform's appearance in two or three days.

— I sent a fax to Yuri Pavlovich Semenov — this is my report on the trip to the CIS, in which I expressed concern about the development of the project in Russia. We did not see through-schedules for the creation of rocket systems for the launch platform and for the assembly and command vessel. I conveyed my concern to the top management, — R. Olson blurted out his tirade to me, lowering his eyes.

— And where is the promised money? — then anger seized me. — You promised it from the moment the Company was formed. More than a quarter has passed — only promises.

— Money is not the main thing, we will solve this problem.

— Then solve it. Dozens of enterprises are working on my word of honor, they have started work under the General's guarantees, the release of design documentation is practically finished, we need to buy metal and set up production, and without money, this is difficult to do.

— We understand.

— Then solve it.

— But I stand by my opinion.

— What do you propose?

— I will send our people to you, I would like them to leave with work schedules. We will monitor this closely.

— Alright. We'll sort out the schedules. That's routine for us. Try to resolve the funding issue.

We left Oslo. As usual — a report to the General. I reported on the status of work on the platform and its modifications.

— That's their business. But you're not doing enough. Tomorrow, gather everyone, we'll have a meeting.

From the boss's tone, I understood that nothing good was to be expected from the meeting.

— Viktor, come in, — the General invited V. P. Legostaev. — I'll ask you to check on the progress of Sea Launch. Our partners are dissatisfied.

— Alright, Yuri Pavlovich, — Viktor Pavlovich replied readily, as always.

It seemed to me that after this, Legostaev V. P. would invite me to his office and we would discuss maritime affairs in detail. But the vice-president's algorithm was different. As a true systems engineer, he drew up a "chessboard" outlining our co-contractors and the composition of exchange data and documents. These included: initial data, issuance of technical specifications, their approval, determination of cost limits, and creation deadlines.

He called the heads of our departments one by one. These were both developers and curators of our co-contractors.

To my satisfaction, the "chessboard" began to fill up; only the funding cells remained empty.

The next day, a meeting.

— I warned everyone that this topic is paramount for you. If you disrupt the work, I will simply disband your departments. You are nothing but losses.

— The beginning was promising.

No one present understood what losses for the enterprise were being referred to. We could live on funds from other projects without resorting to enterprise funds. It was clear that someone had agitated the General, and it was beneficial to someone.

— Let's hear the reports. Who's first? — the General continued.

As usual, they started with Department 6. They had the largest number of co-contractors. V. N. Bodunkov answered all questions. V. P. Legostaev checked his notes and confirmed that everything that could be done had been done by the department, and then immediately showed his "chessboard" to the General. This calmed the General. The conversation shifted to technical problems. The General was particularly concerned that we had undertaken the launch of "Zenit," that this leading role was ours, RKK Energia's, and not KBTM's, and whether we would be able to cope with this task. All questions were answered affirmatively. This also concerned the creation of an automated launch preparation control system.

— We have experience in creating a similar system for the Energia launch vehicle. We understand well what needs to be done. The work is "tied up." — I. V. Zemtsov tried to convince the General.

He seemed to agree, but his face showed that he was plagued by doubts.

The conversation turned to creation schedules.

— In a week, the creation schedules, agreed upon with our co-contractors, must be on my desk.

At that time, fax communication was not yet so highly developed. We had to urgently send our specialists to the co-contractors. For the platform alone, 16 large schedules had to be made, and for the command vessel — 18. These were only the main ones; behind them were second-order schedules. The Americans were arriving in a week. We had to mobilize all forces. The tension was enormous. Leaving work at 9 PM became the norm. My head didn't have time to rest overnight. Saturday was a normal working day. We still couldn't keep up. We had to work on Sunday.

I brought my son Pavel to work to help. The Americans, who were not working at our pace, were very surprised that people came to work for free and worked diligently on “tying up” the schedules. We finished late.

All schedules were ready, and “receipts” for the approval of these schedules were received from the co-contractors.

In the morning, a report to the General. The Americans were satisfied; they got what they wanted. Now, monthly monitoring of work according to schedules is necessary. That was decided.

The enormity of the project pressed harder and harder. It seemed that the head was pulled out, the tail was stuck, and vice versa. The technical side was already more or less coordinated. But the organizational side remained unclear. Everything needed to be discussed at the very beginning of the project work. Later it would be too late. We began to draw various management structures. This needed to be discussed, at least in a first approximation, with Boeing and the Sea Launch management.

A month later, I flew to Seattle. As always, Natasha Magwire met us. Again, the familiar hotel. In the morning, to the company. Boeing leased a special building for the Sea Launch program. Separate offices for R. Olson, P. Inyart, and other company executives.

DIGRESSION

Sometimes you're just surprised at how quickly Americans can change jobs, premises, city districts, and cities themselves. It seems that Americans have remained nomads.

Much later, in conversation, our American colleagues indeed confirmed this idea. For them, it's no trouble to move to a new city, a new state, to the north, south, west, or east. As long as there's work. Everything for daily life is equally established everywhere. They don't have issues with food, phone service, parking, or housing. Everything is equally well-appointed everywhere. This surprised us greatly. After all, it's simply impossible to live like that here. Firstly, passport registration ties people to one place. It's impossible to change or sell housing. It's state property. And as for the surroundings—friends, dachas, garages—there's no need to even talk about it. There was plenty of work everywhere, just don't be lazy. We didn't even imagine then that in a few years all our postulates would be buried. But at that time, the feeling of Homeland was inextricably linked to our place of residence. Perhaps our poverty united people. From childhood, we were instilled with a sense of collectivism and equality. On the one hand, there is much good in this.

Collective labor was more joyful and brought more pleasure. Our holiday gatherings, demonstrations, and after them, table meetings with friends from work in an informal setting, brought us very close.

No nationalistic outbursts were allowed in our collectives.

By our convictions, we truly transformed into a society—the Soviet people. People were valued for their knowledge and ability to work. Perhaps this wasn't the case in every collective, but I was lucky in this regard. In the course of my service, I met Armenians and Ukrainians, Belarusians and Uzbeks, Jews, and the question of nationality never arose. It was much later that someone found it profitable to incite nationalistic disagreements.

How many innocent people died in the process! But I repeat, it was profitable for someone.

And Americans live quietly and peacefully. They have no problems with nationality or people's skin color. Our press wrote a lot about this.

But, having been to America, I never once encountered racial discrimination. On the contrary, many Americans complain that the government is pandering to Black people or their descendants. The

word “negro” is not spoken; it’s offensive. There are dark-skinned people, and that’s it. As if apologizing to those who were brought and sold to settlers as slaves, the most humane laws have been adopted regarding dark-skinned people. Today it’s not a sensation that people with different skin colors fly into space. There are no distinctions. But here, it’s as if we’ve gone wild. Nationalistic feelings are tearing apart the former Union. More and more, the borders of previously non-existent states are being divided.

When will all this end? Americans reassure us that we must go through everything: crime, drug addiction, prostitution, and... But why should we go through this? Again, a huge question.

How I wish to believe that this path will end in our lifetime and our descendants will not have to go through it.

REORGANIZATION

A large delegation from Russia and Ukraine arrived in Seattle. Intense work lay ahead to define the partners' roles in general project matters. These matters included ballistic support for launches, project management issues, including missile asset management, telemetry data transmission during flight and information provision to project managers, organization of flight control centers, and, of course, financing of specific tasks that fell outside defined limits.

The next morning, a small, comfortable bus brought us, the entire group—both Russians and Ukrainians—to the new office.

Immediately, V. G. Komanov and I went to R. Olson. We needed to introduce ourselves upon our arrival. Of course, he was aware that we had arrived. R. Olson was hastily gathering papers. He smiled his engaging smile and greeted us:

— I'm flying to Oslo now.

— ?!

Volodya and I exchanged puzzled glances. It was somewhat unclear. We had just arrived, and he was immediately leaving, without even discussing the main issues.

— I'm going to sign a contract for the platform. Time is pressing, — R. Olson explained the purpose of his departure.

"It seems the Norwegians worked well with the company, given such a rush. Contracts can wait with us, but not with the Norwegians," I conclude to myself.

— Interesting, at what price? This isn't a secret for us, is it?

— Of course not. We set the price at 86 million.

— Who is "we"?

— I and "Kvaerner" represented by Per H. Kristensen.

— But the limits were different and signed by all partners. And significantly less.

— I don't know. I'm late for my flight.

— We don't agree, — was all I managed to say in pursuit.

I told Komanov everything in detail. This was the third time the Norwegians had raised the price without the consent of the Russians and Ukrainians.

I recalled the first instance when the platform was sold for 25 million, and then the price rose to 40 million. I remembered receiving a reprimand from the General, supposedly for counting other people's money.

The second instance was when its price jumped to 47 million

dollars, and now this is the third instance. I will have to stop the Norwegians for the third time.

I call the General. I report the situation:

— This is not good: for the third time, the price is being increased without our consent and that of the southerners. After all, the project price will increase by this amount, and the issues we came here to discuss have not yet been financed.

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V. M. Filin

— I understand everything. We will try to regulate this, — the General reassured me.

— You realize you've made enemies with that call, — V. G. Komanov interjected.

— What enemies?

— Among the Norwegians. They won't forgive you for this. And R. Olson won't either. It seems they have an agreement.

— On such matters, I am obliged to inform the General. He closely monitors cost indicators. He guaranteed them adherence to limits, and they are so free with their own. And even if it's their money, out of respect for their partners, they could have called Yu. P. Semenov or S. N. Konyukhov. No! A contract immediately! We haven't received a single cent yet, but we've launched such colossal activity. What if they back out? How will I look people in the eye? And how will our General look? I acted correctly — I convinced myself of this again, but something inside ached.

After R. Olson's departure, work on project management and other issues slowed down. We only had to resolve minor misunderstandings in the project. There was no one to even raise fundamental, problematic issues with. Three days passed tediously and boringly.

I addressed R. Olson's deputy, E. Steward:

— Usually, when guests come to us, we try to arrange a city tour for them, to show them the sights. Is that not customary here?

My question caught him off guard. After a moment of thought, he replied:

— We will definitely organize it on Sunday. Jerry Wood will accompany you.

Indeed, on Sunday morning, a small bus pulled up to the hotel, and we were driven to the city center. Seattle's first attraction was the Olympic Tower. A very beautiful shape. It resembles a flying saucer with rays emanating from it. At its entrance, D. Wood hesitated a little. We were used to the firm paying for everything if they invited us, but from D. Wood's face, we understood that this trip was unscheduled, the firm had not planned funds for it, and

Americans were not accustomed to paying out of their own pockets. Quickly



D. Wood, E. A. Golovanov, V. M. Filin, V. N. Panarin

understanding the situation, I suggested we chip in and buy tickets. So we did. We ascended to the hundred-meter mark. The view of the lake and the city was amazing. From every side, the city looked extraordinary. Inside the “saucer” were small shops and bars. I suggested to D. Wood that we go into the bar. His surprise was boundless when I ordered fifty grams of cognac and treated D. Wood. He drank it with pleasure and looked at me somewhat questioningly.

It seemed to me as if the Americans thought we were completely destitute, and the behavior of our compatriots only reinforced their confidence in this. Our people constantly put pens, staplers, paper, erasers, and other small stationery items, which were freely available on the shelves, into their folders. The Americans just chuckled. But here we are on top: where prices are prohibitive, a Russian treats an American to cognac. There was indeed something to be surprised about.

We went down to the shopping arcades, just to walk around and look. The abundance of products no longer surprised us. But the game with huge fish, which the sellers put on, was a free spectacle. They deftly tossed the fish from one to another until it landed on the scales, and from there to the buyer. All this was accompanied by cheerful exclamations and brought true delight. I involuntarily wanted to buy one of the fish.

On Monday, R. Olson arrived.

— I would like to ask you (he meant me and V. G. Komanov) to

come see me.

We entered the office. Ron nervously paced the room, approached the windowsill, picked up one glass then another, examined it, and put it back. As we later learned, he collected glasses from all over the world. It was clear from his face that he wasn't thinking about the glasses, but was moving them purely mechanically to calm down.

I asked the first question:

— How's the contract?

— Not signed.

I think to myself: not bad for a start.

— Someone from here called Semenov Yu. P. There was a scandal. I flew to Yu. P. Semenov, but he didn't even receive me.

— Why "someone"? I spoke with Yu. P. Semenov and informed him about your trip. Moreover, I told him that it was un-partner-like to ignore the opinion of the Russians on such fundamental issues.

— You did not do a very good thing. You have halted the project with this.

— I don't understand, why? We've been trying to get funding for missile systems from you for a year, and the issue of platform funding is being resolved right away.

— I will insist on a meeting of partners as soon as possible.

— That's right. We need to, as we say, "agree on the shore."

Upon arriving in Moscow, I reported to the General. As I expected, he was also outraged by R. Olson's actions, but he also understood something else: that we had gone too far with the Americans, and that we would have to reconcile and find common ground.

— Yes, the partners' meeting will be difficult. The project could collapse. I'll send V. P. Legostaev ahead. He's cunning, he'll figure things out before the meeting, and then we'll consult.

V. P. Legostaev flew to Oslo. Two days later, the General calls:

— I'm flying to the partners' meeting. Our questions have been raised again at the meeting.

— Maybe I should come with you? More questions might arise there on the spot.

— And the visa?

— I have one.

— I think it's better if you don't fly.

I heard some concern in the General's voice.

— As you say.

Silence. Obviously, I think, new information came from V. P. Legostaev from Oslo.

— Alright, let's fly.

Buying a ticket and getting on a plane was a simple matter.

A day later, we were in Oslo. Our conversations on the plane were only about the project and how to accelerate funding. I tried to convince Yuri Pavlovich with both arguments and facts that we were at a critical point in terms of deadlines; if money didn't come in, many enterprises would simply "burst," primarily in Rostov.

Again and again, I ask myself: how are things in Oslo? How will things turn out? What did V. P. Legostaev report to Yuri Pavlovich? I remembered how he, bypassing me, compiled his own "chessboard" of the state of affairs. Maybe something else is going on here? It's no wonder Yuri Pavlovich pondered for a long time whether I should fly or not. Why did Legostaev V. P. never call me or give me information? At that time, I didn't understand that this was his style of work. Keeping information was his rule. I was finally convinced of this later. Viktor Pavlovich represented our enterprise not only in the Sea Launch company but also in others, including the Lockheed-Khrunichev-Energia company, and attended partners' meetings as the "foreign minister" of RSC Energia. But not once upon his arrival did he gather the leaders who participated in these works and tell them what had happened. As a rule, the General himself told me about such meetings, thereby orienting and directing my actions. This was very effective and efficient.

Yu. P. Semenov and V. P. Legostaev worked in the "Kvaerner" premises, while their escorts from "Energia" and "Yuzhnoye" worked in the Sea Launch office. The hall for partner meetings was very small, and the chairs were precisely counted to match the number of Council members. The meeting lasted two days.

I couldn't even talk to Yu. P. Semenov or V. P. Legostaev. This surprised me even more and convinced me that the issue of representation from RSC Energia in this project had been raised at the meeting.

I arrive in Moscow a day after the General. I learn that he gathered our department and gave a "dressing down," where much was said against me, including accusations of being unable to find common ground with subcontractors. A stick has two ends, and the second one hit me. As it later turned out, Kvaerner set the tone, Boeing supported it — no wonder I caught them three times with their hands in the cookie jar over money; the southerners silently joined in, also remembering the offense that their role in the project was, in their opinion, belittled, and KBTM actively supported it in the person of its head G. P. Biryukov. He had not forgotten that, due to my fault, the leading role for the launch platform had been taken from him, or rather, not taken, but not given to him.

Another meeting with Yu. P. Semenov. Again, dissatisfaction expressed with the work of our department. And although it wasn't as sharp as before me, I felt depressed. I wanted to drop everything, stand up, and leave. A quick analysis of what happened flashed through my mind. The first conclusion was that, due to the "Sea Launch" topic, work in other areas was proceeding normally. The second was that this was a setup by the partners. The third was that even more had been done than was possible. Practically without money, the advance project and conceptual project were released. These documents linked the entire technical part of the project, and "Energia" was designated as the lead integrator of missile systems. All cooperation was coordinated with our enterprise in the lead role. We worked, as they say, conscientiously. But where was my misstep? The main conclusion: I insufficiently informed the General. Perhaps I took too much upon myself. The partners worked by different rules. And it seemed to me that we needed to work fairly. I realized that the partners had not forgiven me for the financial issues.

The meeting ended.

— We will draw conclusions, — the General said in conclusion.

Apathy set in, a very deep apathy. Working for two years without

weekends and vacations, constantly, day and night, thinking about the project, and then receiving an assessment that you're not doing enough, you inevitably fall into apathy. Your fate becomes indifferent to you.

I came to my office from the General's, I didn't want to see anyone, it was awkward and shameful to look my comrades in the eye. I couldn't defend their work.

Why am I nervous, what's happening to me, why the low spirits? After all, in these two years, I've completely worn myself out. After all, I myself wanted to go to Yuri Pavlovich and ask for help with the work. After all, I myself wanted a reorganization, believing that the project should be in a separate directorate, otherwise, you'll quickly burn out — thoughts, thoughts...

A call from N. I. Zelenshchikov:

— Listen, I'm just coming from the General. He consulted with me about what to do. I advised organizing an independent structure for the project. You already have your hands full. You're responsible for the launch vehicles, you have the upper stage. I think you've forgotten about it a little. And according to the regulations, you bear personal responsibility for it and for the launch vehicle.

— I just finished analyzing what happened. I have the same opinion. I might burst from the strain.

— Write the order.
— For whom? Who will head the new directorate?
— I suggested V. P. Legostaev. What do you think?
— What is there for me to think about? I'm very glad that everything worked out. I thought I would be fired. The best option is to separate the two topics: one is launch vehicles, the other is Sea Launch. I will not and do not want to shy away from the project. There's plenty of work on the upper stage. There will be enough concerns. And thank you very much for such a decision.

— It's not me, it's the General.
— It's good that he took your advice.
— Write the order, — Nikolai Ivanovich said and hung up.
In the LCC (that's the abbreviation for our laboratory and design building), work was in full swing the next day. Builders scurried about, measuring and writing things down.

A. L. Martynovsky calls:

— I don't know what happened, but they gave an urgent command to prepare an office for the General in the LCC. He said he would personally oversee the work on the Sea Launch project. He will be with you two days a week.

— Good news.
— I've been given the command to prepare the premises in the LCC within a month, you'll have to move to another office. We'll also renovate your office. Just bear with it for a bit.

Two days later, V. P. Legostaev arrived. The order had been signed. Yuri Pavlovich was not there.

In the morning, V. P. Legostaev came to me:

— Who set me up? — Viktor Pavlovich began the conversation.
— Definitely not me.
— Yes, it wasn't you, — he said thoughtfully. He sat for a bit, silent.

— Well, alright, I pulled out the control system, then I pulled out the prostheses. We'll pull out "Sea Launch."

— But it didn't sink.
— We will try to make sure that doesn't happen. And do you believe in the project?

— I do. The more I work on this project, the more confident I become. If you don't believe, then why work?

And so we parted ways.

The "Sea Launch" topic was separated into an independent department. V. P. Legostaev became its director. Under him, a scientific and technical center was established, headed by V. G. Aliyev. The launch vehicle directorate was responsible only for the

upper stage in this project. The stage that ensured the fulfillment of the final task.



Valery Geidarovich Aliyev

General project issues practically prevented monitoring the development of the upper stage. At first, it seemed there would be no problems. The upper stage was created based on a prototype of a serial block. What's the big deal, there are minor changes to the lower joint with the rocket: the docking diameter changed from 4100 mm to 3900 mm; the block was fueled, as we called it, "from the heel," and a new control system that allowed for gyrocompassing the block, i.e., determining the true location and direction of coordinates. But behind this lay enormous development work, and all of it was at an initial stage. After thoroughly

understanding the situation, I realized that we could fall behind with the block. I freed myself from the general project issues just in time. I mainly established cooperation with the performers, but there wasn't enough time to identify the factories where the rocket equipment needed to be installed. This was now the task of another directorate. A huge organizational and dispatching workload fell upon it. It was necessary to extract components from subcontractors, organize their delivery, draw up countless installation schedules, deal with employee welfare, and much more. The time had come for the tedious, painstaking work of embodying the project's design documentation in metal. Credit must be given to V. G. Aliyev, V. N. Pogorlyuk, and A. A. Shumilin for, regardless of their personal time, setting aside domestic concerns, practically around the clock, never letting go of the reins of control.

About this period of creating the floating spaceport, there will be another story, which, I hope, will be described by my colleagues.

More than once, partners gathered to resolve strategic issues; more than once, the project would hang by a thread; more than once, thanks to the intrigues of foreign colleagues, the Company would be on the verge of collapse, and only thanks to the joint efforts of our General Yu. P. Semenov and P. Kristensen — the head of “Kvaerner” — everything fell into place, and the project moved forward.

The path to the final phase of the project was long, but it arrived, and on March 13, 1999, the ships departed from the port of Long Beach to the launch point. Everything is ready. What will happen next?!

But let's return to the launch vehicles.



Vyborg. B. Beumuk, V.N. Pogorlyuk, Yu. S. Alekseev, D. Olbow

UPPER STAGE

Fate disposes of us in its own way. I have been convinced of this many times, although all my life we were told that a person is free to dispose of their own destiny.

Although I got rid of the unbearable burden of the Sea Launch project, my worries did not decrease.

Another program was running in parallel, jointly with the M.V. Khrunichev State Research and Production Space Center (GKNPTs).

Having united with Lockheed Martin into the company Lockheed Khrunichev Energia, we offered customers means of launching spacecraft into geostationary orbit. The mass of the spacecraft could reach 2.7 tons. Our foreign colleagues handled the marketing, for which they took up to 20% of the contract value. They carried out their work honestly and conscientiously. More than thirty orders were found, totaling well over a billion dollars.

The first spacecraft to be launched was an apparatus from the American firm Hughes, developed and built for the European customer SES. They bought the apparatus, bought the launch vehicles, and operated the spacecraft in orbit, selling communication and television channels. The income significantly exceeded the expenses. In addition to the technical integration of the apparatus with the upper stage and the rocket, they arranged what were called project defenses. Not only technical specialists but also independent experts and insurers were invited to these meetings. The latter determined the share of insurance payment for the launch. If we convinced them of reliability, the insurance percentage would be one, but if they saw that there were still questions, the customer's representatives would have to convince them for a long time to lower the insurance percentage.

At the time when I was involved in the marine project, B.V. Chernyatyevev was responsible for the development of the blocks. Together with specialists from the M.V. Khrunichev Center, he was constantly searching for consumers of the Proton launch vehicle–DM block system. All organizational work was handled by GKNPTs specialists, while the technical integration and promotion of the DM block was his prerogative. Under Boris Vasilyevich, there was a small design sector and leading designers G.V. Bakanov and V.A. Bogachev. They did not participate in trips, although this was new, and I think none of them would have refused.

— Why are you always traveling alone?

— Because I know the block from all sides, — Chernyatyevev B.V.

replied.

— It's probably not easy, both emotionally and physically?

— Yes, I have to sweat. It's okay, I'll endure.

— Get the guys involved.

— You see, at meetings, they ask the most unexpected questions about ballistics, control systems, propulsion systems, etc. I'll have to bring those specialists too. Not one, but several. That will be more expensive. But this way, I manage alone.

— There are no indispensable people.

— For now, that's true.

That's where we left it. Boris Vasilyevich flew, and the work on adapting the blocks with the payload developed rather slowly. I somehow felt this subconsciously: from the questions of our designers, from the calls of subcontractors. One day, upon Boris Vasilyevich's return from another business trip, I suggested to him:

— Boris, let's get together and talk about the commercial blocks. Invite the heads of departments. Let's hear their troubles and questions, — my call seemed to catch him off guard.

He comes alone.

— I understood that you don't trust me.

— Why is that?

— Why this meeting? I'll figure everything out myself. If necessary, I'll turn to you.

This put me on alert.

— What are you afraid of?

— Me? Nothing.

— Alright. Can I ask you as a friend to tell me how things are going?

— Of course.

— Well, good. Four varieties of the block have already been identified for various payloads. I don't quite understand the differences yet, but the blocks will be different, that's for sure.

— Which one will go first?

— On the DM4 block for the Tempo spacecraft. We decided to designate the blocks by sequential numbers: first, second, third, and fourth. Each for its own program.

— So, there will be a separate set of documentation for each block?

— Not necessarily.

— How then?

— We'll write all the differences in one volume of the project and limit ourselves to that.

— Won't we get confused?

— Well, I'll figure out what's what.

- I have no doubt. What about the others?
- Who are the others?
- The General Director. Maybe I'll have to look too.

Silence.

— Alright. Are there work schedules for the creation of each block?

Silence.

— And how is the financing of the block's development and its manufacturing organized?

— Kiselev A.I. signed a contract with our factory for the manufacture of three blocks.

— But the factory doesn't understand the differences. It works according to documentation. And who pays the designers for the documentation?

— The M.V. Khrunichev Center transferred a million dollars to me.

— What does "to me" mean?

— Transferred to the enterprise for me.

— How should I understand this? And how do you account for this million?

— Not at all.

— ?! Well, I'll be. That's not how it works. Accounting won't approve it.

Boris Vasilyevich pondered. He stared with an unblinking gaze.

— What do you want?

— I want to understand how the work is organized. And that's all. You, as I understand it, cover the technical side. But the organization of the work is not clear to me.

We parted ways. In the evening, he came back:

— Vyacheslav, sign the leave application. I haven't been on leave for five years. I'm tired.

I didn't expect such a turn of events. Signing the application was a bit scary. After all, the work on creating the blocks for LHE was just beginning.

— Where are you going?

— Haven't decided yet. Probably will be at the dacha.

— How can I contact you?

— There are no phones there. But I'll be coming to Moscow.

Asking meaningless questions, I thought agonizingly:

Why such urgency for a vacation? Maybe I offended him somehow? After all, this is just a setup. He should have understood that.

I had to decide: either persuade him not to take a vacation, or... To persuade meant to listen to his conditions for further work, and I

didn't want that, and the conditions themselves might have been unacceptable.

— Alright, give me the application. Oh! You're taking the full term, like a scholar. I've never managed that.

— You sign it, and I'll take care of the rest.

So he went on vacation for the full term. A considerable term — 48 days.

I called the lead designers G.V. Bakanov, V.A. Bogachev, and their boss K.K. Popov.

— Show me the block development schedules. I'd like to know where we stand.

Silence. I look at Konstantin Konstantinovich. Silence.

— So, do they exist or not?

— I wasn't involved with these blocks. B.V. Chernyatyeve handled everything personally.

— But Boris Vasilyevich isn't here, he's on vacation. It also can't be that the development of a block depends on one person. Are we supposed to shut down all work for two months?

The guys exchanged glances but didn't want to answer.

— Konstantin, I ask you to do the following. Assign a lead designer to each type of block. We have enough of them. I give you a week. They should come with work schedules. A separate set of documentation for each block. I also ask V.P. Klippa to reorganize. One sector of V.L. Penchuk, with such a workload, I think, will suffocate. While we are at the very beginning, it's not too late to reorganize. And you personally deal with the project financing issues. It's completely unclear to me how it's proceeding.

I know we have a million hanging, but I don't know how it was accounted for. After all, the M.V. Khrunichev Center might ask for it back if we don't show what work was done for that amount. We need to meet with A.G. Derechin, who heads the enterprise's economic service, and discuss all possible financing options with him.



V.N. Veselov, V.P. Klippa

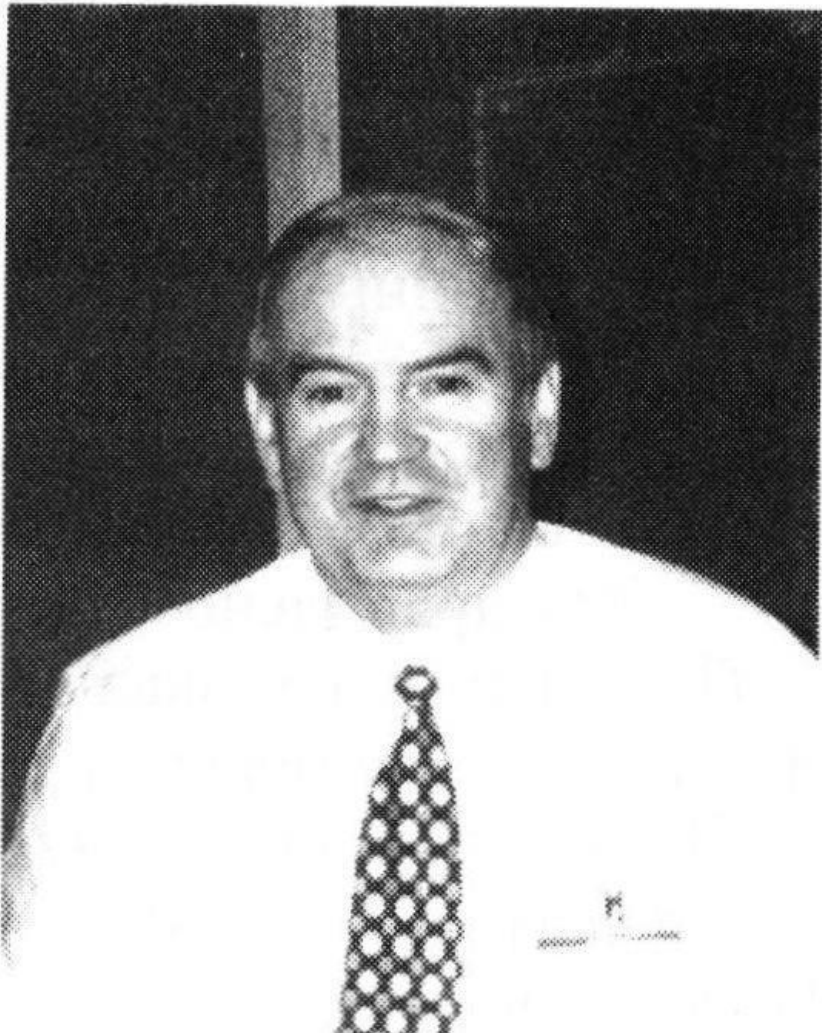
It so happened that fate linked me with Kostya Popov for a long time. Even as a group leader, I noticed him. Good drafting skills and good engineering training distinguished him from others. And the most important quality he possesses is thoroughness. He did everything unhurriedly, as if with laziness. But then it turned out that it was difficult to find an error in his documents and drawings. If he was entrusted with something, one could be calm: he would do it conscientiously, just don't rush him. And if there was an emergency, he transformed, just wiping sweat from his forehead and not getting up until night, but always completed the work. And so we went with him up the steps of our careers. We went through the Lunar program, the Energia-Buran program, got involved in Sea Launch, and, of course, the upper stages. Our General Director, during my absence, sent him as the technical director for the launch. The team respected him for his calm demeanor, for his help in critical situations, and generally, as a good, knowledgeable, competent person.

A week later, the schedules appeared. They needed to be coordinated with the M.V. Khrunichev State Research and Production Space Center. We went to get acquainted. The team of the M.V. Khrunichev Center, which created the Proton launch vehicle, did not lose, like many, its creative impulse and did not stop searching for customers. Its surprisingly active, erudite director, Anatoly Ivanovich Kiselev, was constantly searching. It

was thanks to his efforts that the Lockheed—

Khrunichev—Energia company was created. We somehow passively reacted to this company.

We entrusted him with managing and being our representative on the Board of Directors of this company. Anatoly Ivanovich did not fail to take advantage of this and became the general contractor of the company for the creation of launch vehicles and the launch of spacecraft into geostationary, geotransfer, or highly elliptical orbits.



Konstantin Konstantinovich Popov

RSC Energia turned out to be his subcontractor for the supply of DM upper stages.

The manufacture of three blocks was directly ordered from our factory. A.I. Kiselev placed all orders quickly, understanding that tomorrow their cost could jump several times. Taking advantage of

the fact that space industry enterprises, to put it mildly, were barely surviving, or more precisely, were in a deplorable state, as there were no state orders, he quickly negotiated prices and delivery times. And it must be acknowledged that thanks to his orders, the M.V. Khrunichev State Research and Production Space Center, and certainly Anatoly Ivanovich personally, managed to preserve, precisely preserve, our industry in terms of creating upper stages, rocket engines, control systems, and other components of rocket complexes.

We called the M.V. Khrunichev State Research and Production Space Center. A.I. Kiselev replied:

— Come over. We need to decide how we're going to work. I'd like to consult and discuss.

— We're very happy.

— We'll bring the schedules for the creation of the upper stages.

— Finally. I couldn't get them. How many times did I tell Boris (Chernyatsev). By the way, where is he now?

— On vacation. We'd like to know who we'll be working with on the schedules before they're approved.

— Well, with Kalinin A.A. and Ivanov V.N. One is the factory, the other is the design bureau.

— That's good. I think we need to create an operational and technical leadership. There are many questions, both technical and organizational.

— Vyacheslav Nikolaevich Ivanov will be from our side. And an immediate instruction: prepare a joint order. Any other questions?

— Of course, there are. Just not now.

— That's right.

For each area of work at the M.V. Khrunichev State Research and Production Space Center, a program director was appointed. For the SES and Hughes direction — L.D. Borisov, for the Loral direction — V.Ya. Lopan, for Inmarsat — Yu.O. Bakhvalov, for Iridium — A.M. Seregin.

Program directors bore personal responsibility to the general director for the state of affairs. Their functions were similar to the work of our lead designers, but with broader powers. They had money in their hands. Although small, they could stimulate work.

We agreed to hold meetings alternately, at our place and theirs. One event, thus, was launched, the main thing was for the system to work.

The schedules were agreed upon and approved. It turned out that the differences between the blocks and those manufactured in

series were significant. Their flight programs differed especially, and they also differed among themselves. It was then that our partners realized that merely ordering the manufacture of blocks was not enough. Documentation for the manufacture of blocks was needed, i.e., it was necessary to “put brains into them.” First, the spacecraft had to be “tied” to the block on paper. To specify, as it is now fashionable to call it with a foreign word, the interface — electrical, mechanical, hydraulic, pneumatic connections of the block with the payload. It was also necessary to coordinate the block’s flight program with its capabilities, and not forget to meet the requirements for spacecraft. This is not a matter of one week or month; the achievement of the ultimate goal depends on it.

Communication with the foreign customer was taken over by colleagues from the M.V. Khrunichev Center. Our specialists were left with technical issues.

To the delight of our designers and ballistics experts, foreign business trips became commonplace. The technical training of our specialists was “up to par,” and incomparable to the technical erudition of foreign colleagues, who were characterized by a very narrow area of specialization. The Americans were simply surprised by such depth and breadth of theoretical training of our guys (they did not guess that we were trained as broad-profile specialists).

But the work of design engineers had to be paid for. We gathered at RSC Energia. We began to develop proposals. To discuss the rules of the game. Each work had to be carried out under a contract and, as they say, for every “sneeze,” to account for every “comma.” Moreover, the M.V. Khrunichev Center proposed paying money directly to our subcontractors, bypassing us. We were responsible for the block, and what our subcontractors would do was controlled by the Center itself. We could not agree to such a role. Our firm had always played the role of the lead organization in various projects, but here we were offered secondary functions. We went to the General Director. We proposed to stipulate a certain percentage for the block from the contract value in the agreement. We long calculated what this would be. We found that we would fit within 13 percent. Yuri Pavlovich agreed.

— You’ll fly with me to the launch (to Baikonur). Anatoly (Kiselev) called me, he’ll also fly with Kalinin A.A. and Popov V.N. We’ll agree there.

Quite a few high-ranking guests gathered for the launch of “Kvant” — a module for the Mir orbital station. The General Designer of the Salyut Design Bureau of the M.V. Khrunichev State Research and Production Space Center, A.K. Nedaivoda, arrived. However, I never managed to meet with Kalinin A.A. and Popov

V.N. There was some hustle before the launch, and after the launch, everyone rushed to the planes. I went to pack my things. Anatoly Konstantinovich Nedaivoda flew into my room:

— Sign the decision on the cost of the DM block.

In his hands, I saw a draft decision, but the percentages were already different. To my puzzled look, Anatoly Konstantinovich said:

— We have already agreed with Yuri Pavlovich on the new percentage. Sign it.

— But that won't be enough for us to develop the block.

— Are you against the General Director's decision?

— No, not at all. It's just surprising how you charmed him.

— Not charmed, but agreed.

— Strange.

— What, you don't believe me? — Anatoly Konstantinovich continued to press, — I am still the General Designer.

— If they decided so, then they decided so, my signature is not needed then.

— And he asked for it to be endorsed.

I took the decision in my hands. I read it quickly and somewhat indifferently, then put my signature in the corner.

— No, you sign it. Yu.P. Semenov asked you to sign it.

— The decision needs to be looked at carefully. I'll sign it in Moscow.

And again:

— What, you don't believe me? We agreed on the entire text with your General Director.

I took the decision and signed it.

— Let's go, they're waiting for us.

All guests and testers gathered traditionally in the dining room. As they say, to celebrate success.

I approach Nikolai Ivanovich Zelenshchikov:

— Is it true that you agreed with Yuri Pavlovich on 11 percent?

— Yes, he gave his approval.

A.K. Nedaivoda approached:

— Nikolai Ivanovich, endorse the decision.

Nikolai Ivanovich looked at me. Shrugged his shoulders. The signature was obtained.

The general joyful mood did not bypass Yuri Pavlovich. He joked a lot, uttered warm words to those present. I see Anatoly Konstantinovich approaching and slipping him the decision. A glance in our direction. A nod of agreement. And the decision is signed.

We flew to Moscow. Something felt wrong inside. I compare

the decision with our preliminary work. And so it is. The percentage was taken not from the correct value, not from the contract cost, but from a specific scope of work.

I call Nikolai Ivanovich.

I explained briefly.

— Come over. We'll go to the General Director together.

We enter. Fortunately for us, Yuri Pavlovich is in a good mood.

We are silent.

— We've come to get what's ours, — Nikolai Ivanovich began.

— What is it?

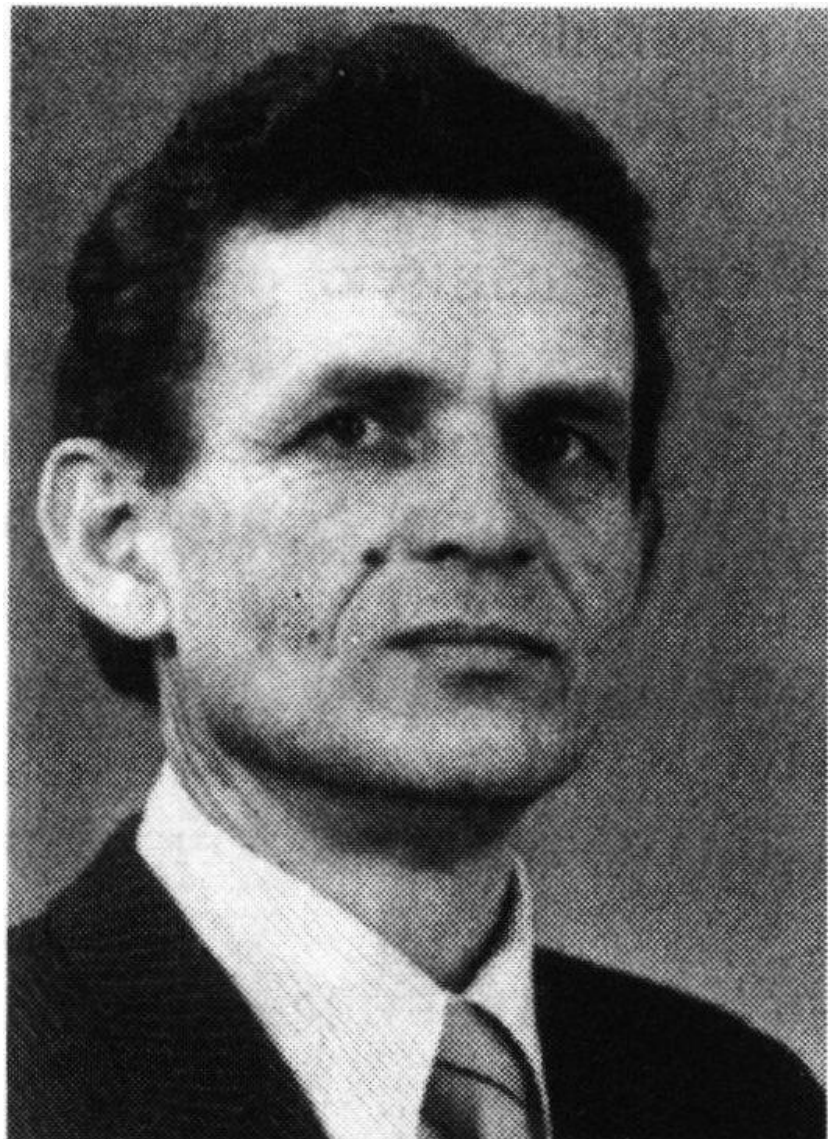
— They just cheated us.

— How so? And where were you looking?

— This is already addressed to me.

— I overlooked it. My fault.

— It's not my job to compare everything down to the comma. I trust you. And you let me down.



Nikolai Ivanovich Zelenshchikov

It was useless and disgusting to make excuses. One could only blame oneself. From the General Director's tone, it was clear that we wouldn't get into too much trouble.

— Alright, I'll call Anatoly Ivanovich.

He picked up the phone.

— How are we doing? — he asked Kiselev A.I.

And then, without hesitation:

— Do you always act this way? Taking advantage of the occasion, at the festive table, you slip documents with petty fraud. And it's the General Designer who slips them, — Yuri Pavlovich uttered sarcastically.

He held the receiver for a long time. Listened. Answered monosyllabically. We stood, stunned, understanding that we had forced our boss to humiliate himself.

— The document is annulled. There will be a new one. Just don't be fools in the future, check and recheck.

With that, we left, delighted.

We corrected the decision and agreed in principle. Now we needed to draw up a payment schedule for the manufacture of the blocks.

Together with Konstantin Konstantinovich Popov, we went to the M.V. Khrunichev State Research and Production Space Center, where Anatoly Alekseevich Kalinin and Valery Nikolaevich Popov literally sketched out this schedule in a few hours. We dispersed to our respective companies, checked everything again, and had it approved by the General Directors. The financing issues were settled. Cooperation was worse. Our subcontractors were literally suffocating from lack of money. Many were put on a reduced work week, others were sent on long, unpaid leave.

— I'll help you with your cooperation. Let's go together to the subcontractors, they are the same for both of us, — suggested Anatoly Alekseevich Kalinin, director of the Rocket and Space Plant (RKZ).

— With pleasure. We need to go together so that our colleagues don't speculate on us.

That's what we decided. A.A. Kalinin is a pure production specialist, he understands the nuances of manufacturing complex equipment very well. Moreover, his sociable manner of conversation endears him to enterprise managers. They are all friends to him.

So we set off with him to Sosensk, near Kozelsk. The modern instrument factory seemed to be sleeping, resting before a big task.

In the office of the factory director, Valentin Vasilyevich Subbotin, we talked about the prospects for orders.

— I don't believe you, — Valentin Vasilyevich said frankly, — do what you want, but I don't believe you.

— That's your business. But let's agree on the delivery schedules for the upper stage control system and specific financing.

— You already owe me several million.

— So let's write down how and when we'll pay it back.

— A.A. Borisenko called several times, but what good did that do?

— Now the financing will go through us, through the lead enterprise.

— Let's try. But I don't really believe it.

— We have drawn up a clear payment schedule with the M.V. Khrunichev Center.

A.A. Kalinin nodded, indicating that it was so.

— Now the receipts will be regular, and I think we'll soon close your gap.

It was lunchtime. From the office window, one could see people streaming out of the checkpoint. Or rather, just a few people.

— You see what they've done to the factory, — V.V. Subbotin mused, addressing no one in particular.

— Yes, not much, — Anatoly Alekseevich agreed, — but in two or three months, I think the picture will be different.

After Sosensk, there was Krasnoyarsk, and everywhere the same deplorable picture.

Work, and then its financing, were just beginning to get organized.



Anatoly Alekseevich Kalinin

It was especially difficult with the Krasnoyarsk Machine-Building Plant. Director Viktor Kirillovich Gupalov was a good manager of the giant plant. Once, the plant worked rhythmically, producing more than eighty ballistic missiles a year, thousands of Biryusa refrigerators (decent refrigerators), and other products. He also helped in the manufacture of individual components for the Energia launch vehicle. In the DM block, he was responsible for the modular part, and essentially, the entire propulsion system. The engines themselves the plant received from Voronezh.

The director's authority was felt at the plant. Viktor Kirillovich made incredible efforts to "knock out" debts from the Ministry of Defense (even sued) and from our enterprise. It got to the point where he quarreled with our General Director, so much so that after that neither he nor Yuri Pavlovich wanted to speak to each other.

V.K. Gupalov was also valued in the Ministry (when it existed). V.K. Gupalov was one of the first to receive the “Honored Machine Builder” badge. Badge of distinction number one. This was during the glorious time of the Energia-Buran system development. Soberly assessing the situation and understanding well that the DM block could become one of the main topics that would bring money, Viktor Kirillovich did not stop the production of modular parts. He swore, demanded, threatened, but did not stop production.

The trip to Krasnoyarsk was one of the most memorable. We were with the deputy director of the plant for production, Oleg Yurievich Kalashnikov. In addition to the modular part, Krasnashzavod made “scattered parts” — individual structural elements of the block — for our plant.

V.K. Gupalov personally showed us around the factory. He showed that the production of blocks was separated. He showed the engine production. It was unexpected to see a well-equipped production facility.

At the meeting in his office, we needed to decide on delivery schedules and payments. We explained how we had agreed with the M.V. Khrunichev Center. He asked no questions. But when it came to the price, we had a hard time. He pressed us with all his Siberian might. In the end, we agreed. We signed the documents. Yuri Pavlovich was very surprised later at how we managed to find common ground. V.K. Gupalov took us to the Krasnoyarsk Sea, where we saw the extraordinary beauty of Siberian nature.

Then there was Voronezh. The Voronezh Mechanical Plant specialized in the production of rocket engines. It produced engines for Soyuz, Proton, combat missiles, and made our 11D58M engine.

Now orders have sharply decreased. The young director, Anatoly Ilyich Chasovskikh, took orders from Gazprom. It was painful to watch how metal ingots — bodies of shut-off valves — were machined on high-precision machines. But they received a good salary. Nearby, engine parts were being machined. The salary was less, but the responsibility was greater. A paradox.

The funds allocated for the creation of the block were clearly insufficient. What to do? We had to break the socialist principle. The fact is that enterprises sold not their own labor, but added the products of their subcontractors to it, thereby achieving a certain increase in profit for their enterprise.

I spoke with Yuri Pavlovich. He supported the idea of paying only for one's own labor, understanding well that the cost of production would be lower, and therefore he would have a greater profit from the sale of blocks. In this regard, a decision was born. We had to sweat until the subcontractor directors signed it. A.A.

Borisenko — director of ZEM — remained. We had to ask the President of the Corporation (who was our General Director) to intervene.

Thus, a historic decision was issued. How it later helped us in the manufacture of marine upper stages! Sea Launch gave us even lower cost limits than the M.V. Khrunichev Center.

In February 1996, like a bolt from the blue — an accident. During the launch of another satellite, the second ignition of the upper stage failed. And this was on the eve of the first launch of a commercial satellite. A commission was created to investigate the probable causes of the accident. It was headed by Major General V.M. Vlasjuk from the military space forces of the Ministry of Defense.

A two-week deadline was set. We turned over all the technology, reviewed the deviation cards during the manufacture of parts and the block as a whole, and analyzed autonomous and complex testing. We could not definitively establish the cause, but determined the most probable one. The launch fuel did not enter the gas generator and combustion chamber. Chemical ignition failed. The reason could have been clogging of the pipeline or loss of its hermeticity (a fitting came loose). We drew conclusions and implemented measures for this ill-fated pipeline from the launch block to the engine. Our military was reassured by this. They were not “blamed.” Although they operated this block (i.e., prepared it for launch) under barbaric conditions. But to blame them for the accident would mean to spoil relations, and we still had work to do. So we got out of it.

The General Director repeatedly gathered us with materials on the accident. He questioned whether we had reviewed everything, and whether the cause had been definitively established.

Our foreign customers learned about the accident. The spacecraft was already at Baikonur. The question arose about its return. A.I. Kiselev called Yuri Pavlovich. It was necessary to explain the causes of the accident to our foreign customers, to reassure them. To explain the seriousness of the moment.

We rehearsed the report with the General Director. He approved it.

I arrived at the meeting at the M.V. Khrunichev State Research and Production Space Center. It was held in the “service hall.” A well-equipped meeting room designed for negotiations with foreign specialists. I was surprised: about twenty foreigners and six people from the M.V. Khrunichev Center were sitting at the table. It turned out that our foreign customer had invited various specialists in propulsion systems, control systems, and other systems to this

meeting. The first deputy general director of the M.V. Khrunichev State Research and Production Space Center, Alexander Alekseevich Medvedev, took charge of the meeting, he headed the Russian side and began his report, to my bewilderment:

— The operation of the Proton launch vehicle proceeded without deviations from the norms.

Then he described in detail, as if boasting, the rocket's operation second by second.

— Are there any questions?

There were, naturally, no questions. The polite foreigners endured the report without uttering a word. They needed a different report. A report on the accident of the DM3 upper stage, which I had to deliver.

I walked to the monitors.

— You must convince us that we are not in any danger. You must report to us on the results of the investigation into the causes of the block failure and the measures taken to prevent it in the future. Otherwise, we will take the apparatus and leave you for the Ariane launch vehicle, — the senior representative of the customer warned me.

His gaze, impudent and ironic, seemed to say: “You still won't be able to do it.”

I endured.

— We have definitively established the causes of the accident. The fact is that the launch was on the 13th, a Monday.

Everyone began to write seriously.

I waited a minute. I realized the joke didn't land.

— The Proton rocket, about which you have been told for so long, has nothing to do with this. There are no complaints about its operation. The upper stage is to blame. Which is what we will talk about now.

They livened up. Some even smiled. Now it would be easier. In detail, showing slides, I explained how the search for causes proceeded, how one version of the accident cause was discarded and another appeared. Analysis — and again it was wrong. I structured my report so that the listeners had questions, which they didn't have time to ask, as my next words were the answer to these unasked questions. The report was finished. Questions poured in one after another. There were serious, businesslike questions, and sometimes simply funny, incompetent ones. I patiently gave explanations:

— We need to consult. Let's take a ten-minute break.

Three hours had passed. We were without lunch. Those sitting at the table could eat a sandwich.

I stand.

— We are not convinced that you have definitively identified the cause of the accident, — concluded Wiener Kernes, — a representative of SES.

I'm silent. Why justify myself?

W. Kernes couldn't stand it:

— We still have many questions.

— Ask away. I'm not in a hurry. I'll try to answer. And if not, I'll call my specialists. They'll answer.

— Alright. Let's continue.

Questions, questions, questions. They asked the same question from different angles, preserving its essence. I answered patiently. It seemed the questions had run out.

— Let's take a break. We need to consult. — The foreign delegation leaves for another room.

We wait. They appeared.

— You have practically convinced us that all measures to exclude similar phenomena have been taken. But questions remain.

And again questions, questions. — They are repeating more and more often, — I note, — I need to answer monosyllabically.

— I already answered that question. Twice. — The foreign colleague blushed slightly.

— If it's not clear to you, then I need to know your specialty and education to answer in a language you understand and using terminology accessible to you.

A slight murmur went through the hall. Two or three more questions.

I answered.

— We need to confer.

The entire group left the hall.

Five and a half hours passed. Finally, they are coming.

— You have convinced us. We see that you have worked through everything very seriously and meticulously. We entrust the spacecraft to you.

— Let's draw up a protocol immediately, — this was already the intervention of ILS company president C. Lloyd.

The protocol was drawn up very quickly. The agreement was recorded.

— You're amazing! Congratulations. I brought my specialists. Just in case you needed help. It wasn't needed. I was surprised at first that you came alone. True, I invited the chairman of the accident commission for backup. But overall, it's good, — Alexander Alekseevich Medvedev gave his assessment.

Immediately after the meeting at the M.V. Khrunichev State

Research and Production Space Center, we flew to Baikonur.

Ten days remained until the launch of the Astra-1F spacecraft. The block was fueled. Docking with the spacecraft went without remarks.

Meeting of the interstate commission. Vladimir Leontyevich Ivanov presides. Ivanov V.L. — Colonel-General, former commander of the Space Forces, an experienced specialist in his field. He has given a ticket to space to hundreds of different rockets. For ten years, he headed the state commission for manned launches. How many cosmonauts were launched into space after his blessing. He conducted commissions very meticulously and, if necessary, made radical decisions to fulfill the assigned task.

There was such a case when, during the last tests, a valve in the Soyuz rocket failed. Literally within two days, the rocket was replaced from the combat kit, and the delivery time of the Progress cargo ship to the Mir station was met.

After his resignation, Vladimir Leontyevich came to the M.V. Khrunichev Center. Given his vast experience, by decision of the Ministry of Defense and the Russian Space Agency, he was appointed chairman of the commission for conducting commercial launches of spacecraft using the Proton rocket and the DM upper stage.

And now — a commission meeting before the rocket is rolled out to the launch pad. It is traditional. The readiness of all systems for launch is checked once again. Reports are heard on the readiness of the spacecraft, the upper stage, the rocket itself, the rocket preparation center, the launch measurement complex, power systems, the ground control complex, ballistic support, as well as the meteorologist's report.

At the presidium table, in addition to V.L. Ivanov, there were three General Directors: Yu.P. Semenov, A.I. Kiselev, A.K. Nedaivoda. They listened carefully to the reports.

The launch of the Proton with the DM upper stage was already somewhere around the two hundredth. All launches had been successful. There had been some unpleasantness during launches in the early stages, and the last launch also let us down. Hence such attention to this first commercial launch. God forbid...! It would be a disgrace to the whole world!

Many foreign guests arrived, and, of course, the ILS management. Everyone is nervous. The launch has passed. The Proton launch vehicle worked well. Now it's our turn.

— Where can I watch? — asks Yuri Pavlovich.

— At the Polet Hotel.

— Where is that?

— At site 92.

— Let's go.

Busy with preparations, and also burdened with superstitions, I had not been able to visit the communication room before this. We arrived. The communication room was already packed with people. Our first activation was an hour after injection.

— Report on the block.

— It entered the invisible zone normally. The SOZ (launch support system) propulsion units pressurized, the middle adapter was jettisoned.

— And how is it now?

— We need to wait.

— How long?

— About thirty minutes.

And it began. Why are we here? Where is our control room? Why didn't I report this? The complaints were fair. But the moment was not chosen very well. My head was spinning. Thoughts about the block, how it was doing, raced through my mind. I understood that the General Director was nervous, and this was transmitted to us. My blood pressure, it seemed, had jumped to two hundred.

— Leave them alone for now, — advises Yuri Vadimovich Trunov (future General Director of NPO AP), — You see how they are. They might have a stroke.

— SOZ propulsion unit ignition confirmed, — these words act like good medicine. It means the block has started working. There is information.

— Main engine ignition confirmed, — this is completely reassuring.

Yuri Pavlovich calmed down. It was one in the morning.

— I'll go to my place. Call me when the second ignition happens, — he addressed me peacefully.

— Alright, I'll call. I'll be here.

The second ignition went smoothly, without any issues.

I reported.

— Congratulations. Give me proposals on how to organize our own control center at site 254.

We went to report to the Chairman of the commission. At the cottage, I met A.A. Kalinin. We embraced, mutual congratulations.

— Don't bother them, — Anatoly Alekseevich said, referring to his General Director and the Chairman, — they just fell asleep. They are aware that everything is in order.

— And when is the commission meeting?

— I don't know. We're flying out in three hours.

— So, there won't be a summary of the results.

— Probably not.

— That's a shame. We should at least thank the people.

I went to my native “deuce” (site № 2). The guys were waiting. I congratulated everyone, and we took pictures for memory. After all, this was the first commercial launch.

The work of preparing commercial blocks for launch became routine. This did not relieve the responsibility and tension, but it was already proceeding along a well-trodden path. There were commercial launches of Inmarsat spacecraft. Three launches of Iridium spacecraft. There were no complaints about the insertion. And the accuracy provided by the block was simply fantastic.

DM-SL BLOCK

There seems to be nothing special. The block has been developed and has been in operation for a long time. It flies well. Just take it and transfer it to another rocket, let it fly. But only a person unfamiliar with technology would think that. Yes, at first glance, nothing has changed. But how much effort had to be put into this so-called adaptation, i.e., adapting the block to other operating conditions. We also thought that we would keep a well-developed propulsion system, and there would be no problems with the rest. There weren't any, but there was still a lot of work.



April 7, 1998. In the flight control room. 254 after the third launch under the Iridium program. Standing: V. Chemata, S. Zakharov, P. Avdeev, V. Filin, A. Tishin, A. Dietrich, Yu. Tsyplakov, S. Zuntov, A. Sorokoumov, V. Kovalkov, V. Zadeba, A. Shcherbakov, S. Prokofiev, V. Popov, V. Bobrovsky. Sitting: B. Smirnov, V. Moskvina, G. Kadakina, V. Mashchenko

First, it was necessary to “tie” the block to the Zenit launch vehicle. This means that the block must interface with the rocket both mechanically, hydraulically, pneumatically, and electrically.

The docking diameter on the Proton rocket was 4100 mm, and on the block it was 3900 mm. Like it or not, the design of the lower adapter had to be changed. At the factory, this meant modifying the jig.

The Zenit rocket does not have a service tower. Our block needs to be fueled through the rocket. This means that all fueling

equipment must be located on the lower adapter, new breakaway devices must be developed, tested, and proven. New equipment (valves) must be created and subjected to the same operation as previously installed equipment: first sample tests,

design refinement tests, final tests, reliability tests, and, finally, acceptance tests of the standard sample.

It seems like a simple task — adaptation — but it requires enormous efforts from designers, manufacturers, and testers.

When launching from Baikonur, the rocket is aimed to ensure the required launch azimuth. Special benchmarks are placed on the ground along the true meridian, and the rocket is aimed relative to them. On the water, in the ocean, such benchmarks cannot be built. Aiming has to be done differently — by gyrocompassing. The old DM block system could not do this. It had to be changed. The reliable onboard computer was also changed. It needs to be tested. It's impossible without it. And the old "ground" system has outlived its usefulness. Our old friend from Buran, V. L. Lapygin, and his deputy, V. V. Morozov, took on this task. What efforts it took to develop such a system! The country was in chaos. E. L. Mezheritsky suffered particularly. After all, the entire component base collapsed. It had to be literally collected bit by bit. It's not enough to collect and manufacture; a special simulation stand must be created. The equipment must be taught to work on the stand, and then supplied to the products. It's not easy to assemble the stand. It was even more difficult to develop the software and mathematical support. It was necessary to interface the onboard computer of the upper stage with the rocket's computer. After all, the upper stage and the rocket would only meet in America. We didn't need to run into any "beans" across the ocean. We worked it out. There were also difficulties with developing the flight mission. One run after another on the stand, and so on until departure. In addition to flight mathematics, development and testing mathematics were also needed. Everything was recorded on a floppy disk. It's good that email worked without failures. It's a miracle of the twentieth century: receiving launch data by fax in the middle of the ocean. And we received the last correction two days before the launch.

The third major change to the block was the payload integration. Boeing set condition after condition. Special conditions for the cleanliness of their spacecraft. They said we could contaminate it, and then the service life of the spacecraft would sharply decrease.

"Listen, Olson, why do we need a headache? Let's separate the spacecraft from the block with a partition. This is also good from the point of view of preserving your secrets."

He laughed.

“You want us to have a headache.”

“Of course.”

“Good idea. I agree.”

Thus, this encapsulated payload variant was born. We lowered our “donut” — the instrument compartment — and introduced a transitional “skirt” into the design. The spacecraft, wrapped in fairing shells, was attached to it. These three changes led to minor details. The thermal control system had to be redesigned, as the new control system equipment produced increased heat dissipation. Thermostatting issues were also quickly resolved.

It was necessary to introduce special antennas that would transmit information via satellite to us in Moscow.

Everything had to be tested and verified. Boeing sent us the transitional “skirt,” and the “Southerners” sent their instrument compartment, so each block was uncoupled (fitted) with adjacent compartments at the factory. The first fitting of mating compartments in the assembly shop of our factory was particularly memorable. The American transitional “skirt” was elegantly made. In our opinion, it was overweight, but the quality of manufacture was enviable.

First docking. It seemed nothing should happen, because the master jigs had been adjusted beforehand, which meant that everything — both the mounting holes and the studs — should align.

The Deputy General Designer I. S. Efremov was always present at such operations. Paper is paper, but iron is iron. Quite a lot of people gathered. The upper stage was in the jig. Command! And the crane slowly lifts the “skirt,” which hangs over the block. The jig limits the simultaneous presence of fitters on it to six people. The rest of the observers are below. Everyone looked up and watched as the transitional structure was carefully lowered onto the block. Up top, everyone bent down and watched the alignment of the studs on the upper stage and the holes on the “skirt.”

“Stop!”

The crane stopped.

“Hoist!”

His strength engineer A. A. Romanov runs up to I. S. Efremov. He whispers something in his ear.

“Let’s go,” he suggests to me.

“What happened?”

We step aside.

“Idiots, they hit the block pipe.”

“Which pipe?”

“There’s a drainage pipe coming from the top of the tank. They hit it with the crossbar. And it’s on a thermal bridge.”

I remembered. Indeed, for rigidity, the Americans cross-connected the lower frame of their shell. That’s what hit the pipe. Everyone was looking at the joint, but they “didn’t even notice the elephant.” They say, “Too many cooks spoil the broth.”

“What are we going to do?”

“We’ll fix it. It’s not difficult. We’ll analyze and fix it. But we need to report it to the General. That’s harder.”

Anything can happen in production. I noticed that funny incidents often occur when the management is present. The General, I think, was also very “pleased” with what happened.

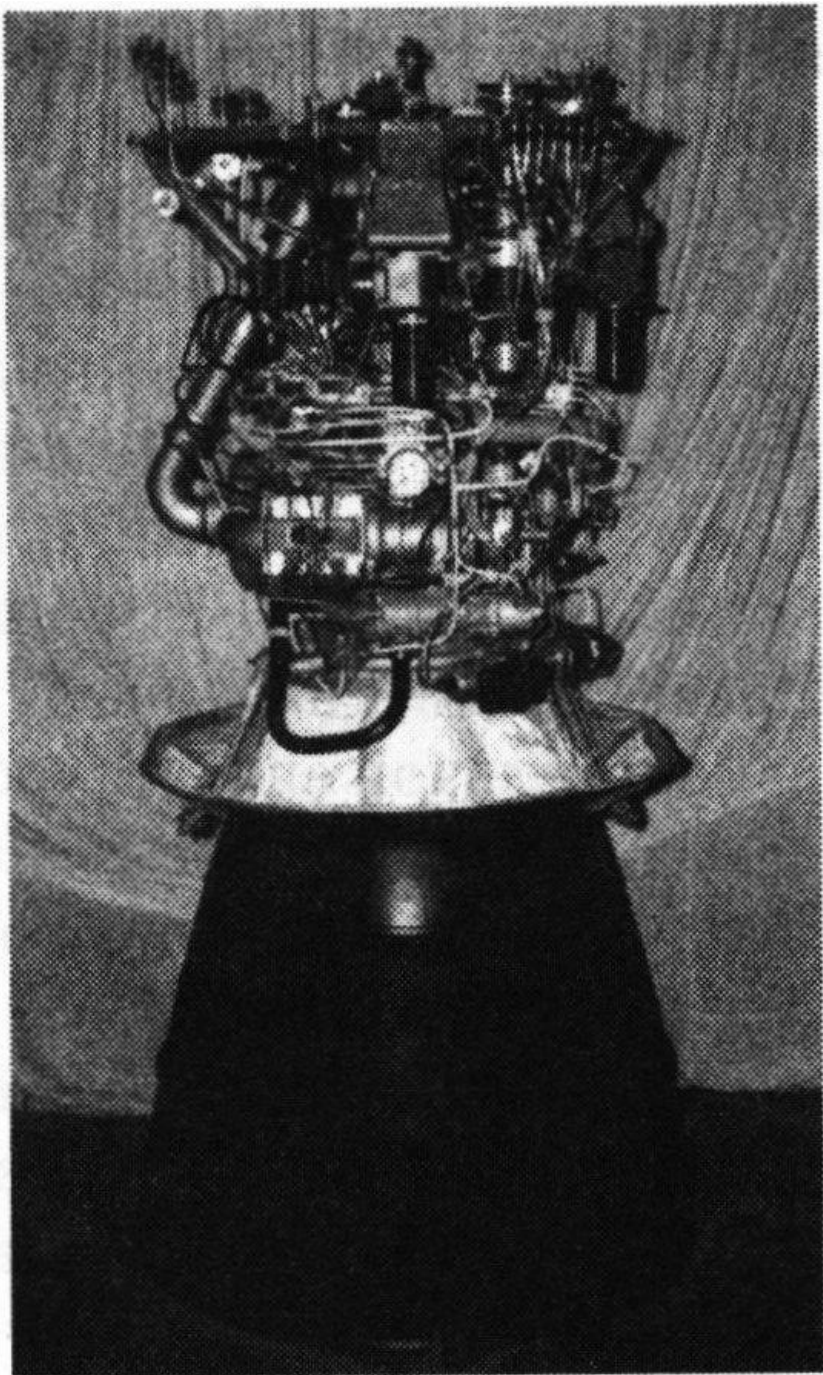
It seems that what happened was an accident. So many eyes. But if you analyze it, such cases happen quite often. It seems that production is already debugged, a series is underway, but no — authorization cards appear.

Someone made a mistake, and the production worker rushes to the designer. They are not allowed to make a decision themselves. This is also thought through. Sometimes even microns in rocket technology determine success. The production worker may not know about this. An unwritten rule exists at the factory: if you made or saw a defect, don’t hide it. Yes, you will be scolded, perhaps even punished for educational purposes, but the managers understand that it would be significantly worse if you hid it and...

One of the systems that caused us torment was the main engine control system. The old block had a single control system that, in addition to ensuring the block’s movement, performed control functions for all block systems. This system, when necessary, activated the radio complex, telemetry, controlled the thermal regulation system, and, of course, the main engine.

So our engine specialists, B. A. Sokolov and V. G. Khaspekov, decided to somewhat lighten its workload. While the old blocks simply had a fuel component ratio regulation system with temperature compensation, for the marine block they implemented an entire main engine control system.

Fuel components flow from the tanks to the engine in specific proportions. If their percentage — the ratio — is violated, the engine’s energy characteristics drop, and fuel consumption from the tanks will be uneven and greater than calculated. The fuel component ratio regulation system on serial blocks solved this problem.



Main engine 11D58M

The process of starting and stopping the engine is a set of well-defined actions of the engine's automation. The engine specialists decided to expand the functions of the component regulation system, entrusting it with the functions of starting and stopping the

engine. This achieved a dual benefit. First, it relieved the main control system, simplifying it, and second, by integrating this system into the engine, its operability was verified during the engine's hot-fire tests. This was precisely during hot-fire tests, which was impossible with the old system. Work on implementing such a system (we abbreviated it as MCS) had been ongoing for several years and reached its final stage by the time the block was ready. We decided to take a risk and installed it on the DM-SL block.

Nothing new is ever simple. Comments on the system's operation poured in one after another. Chief Designer Sergey Vladimirovich Bakaleev literally lived at the control and test station, and V. G. Khaspekov and A. V. Sorokoumov tried to help him in any way they could. They delivered the block, delivered the system, but no: they received comments already in America. S. V. Bakaleev had to fly to Long Beach.

The launch from the equator in the middle of the Pacific Ocean was also not entirely ordinary for us. The fact is that both the first and second engine firings, and the insertion, as a rule, two-impulse, occurred outside the visibility zone of Russian ground stations. Losing information about the block's operation means not finding the cause in case of failure. It means simply throwing tens of millions of dollars to the wind. Such a case occurred in 1996 when Mars-96 was launched. Money for the object was found. Many foreign firms and scientific centers were involved. In general, there was a terrible fuss before the launch. Presentations, interviews, and so on, but there wasn't enough money for a ship with measuring equipment, which was necessary in the Atlantic, and to which telemetry would be dumped. Or rather, not for the ship, it was ready to sail, but for its voyage.

In response to the categorical demand of our organization, a decision was written that, in case of unforeseen circumstances, RKK Energia would not be responsible for the operation of the block. That's how it is! And off they flew.

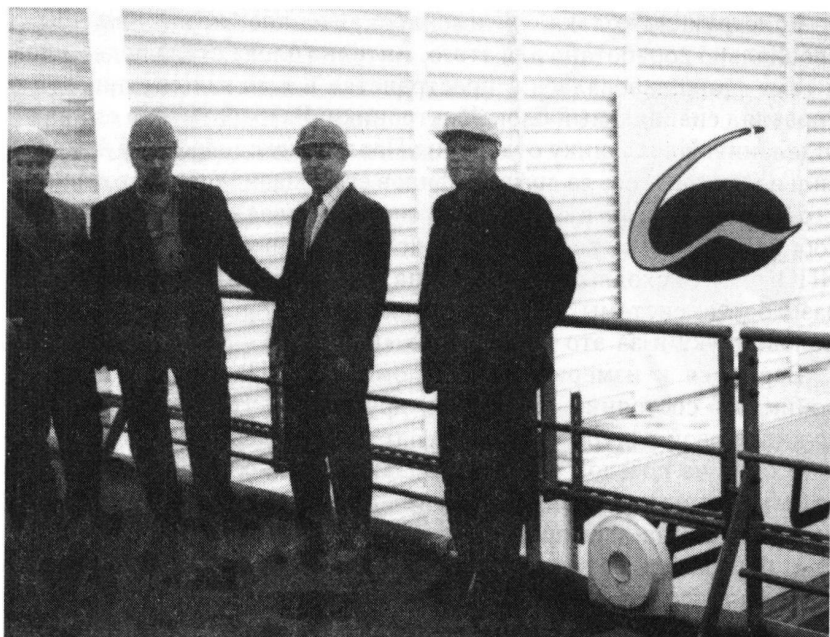
At Baikonur, there was a huge crowd. The General Director of the Russian Space Agency, Yuri Nikolaevich Koptev, brought a whole plane full of guests with him. The Proton flew away, everyone rejoices. There is a report on the block's operation. The briefing is about to begin. It turned out they were mistaken. The orbital block did not provide the necessary impulse, everything fell into the ocean. I misspoke not by chance: about the orbital block, not the upper stage. During the launch of Mars-96, the spacecraft took over control of the block to save mass.

A commission was formed, headed by Academician V. F. Utkin,

but the cause was not definitively determined.

All this is said to emphasize that the question of obtaining reliable information during the flight of the DM marine block was very acute.

It was decided to use a Russian relay satellite and set up a floating measurement station along the flight path — the vessel “Selena.”



S. V. Bakaleev, V. M. Filin, V. V. Morozov, V. G. Khaspekov during the inspection of the SP in Vyborg

The design of the block, namely the antenna system, was specially modified for this purpose. The block's antenna became movable and oriented itself in space in search of the satellite. It was controlled by a special electronics unit. Our department developed it. The head of the department, Pavel Alexandrovich Avdeev, was severely criticized for disrupting the schedules for its creation and manufacture. His department was the curator for the control system. They collected all the requirements for the control system and provided the initial data for its development to NPO AP. Since the development of the system was also “lame,” P. A. Avdeev and V. V. Kolodiychuk also got “their lumps” for this.

Let's return to the measurement complex. Our telemetry specialists understood the state of both: the relay satellite was nearing the end of its service life, and the “Selena” required money to deploy.

During one of his trips to Seattle, Vladimir Nikolaevich Panarin, who was responsible for the measurement complex and

telemetry, suggested to Boeing to duplicate the telemetry dump through us, i.e., to transmit it through the block's systems. He persuaded, proved the necessity, and finally, as we used to say, "pushed it through" — they defined the functions: who does what, defined the connections; in short, the interface was uncoupled. It turned out that not only could the payload block provide information through the DM block, but we could also transmit our information through the antenna installed on its adapter compartment. A good proposal. I think Vladimir Panarin and Sergey Zuntov themselves did not expect it to turn out so well.

Approximately six months before the launch, the Russian relay satellite exhausted its resource. Only the ship "Selena" remained as a hope. Sea Launch did not have much money. It was decided not to deploy the ship — additional costs — but to transmit our information from the block through the American satellite system TDRSS. American rockets fly this way, transmitting their telemetry through this satellite system.

At the partners' meeting, the "Southerners," represented by S. N. Konyukhov, supported the Americans. We had nowhere to go. We accepted it as a given, but with the caveat that we would not fly until we tested this data transmission system before the flight. In addition, we added to the list of abnormal situations that in case the TDRSS system does not support the flight, the flight is impossible. The Americans guaranteed this and fulfilled their obligations.

The ill-fated electronics unit controlling the antenna became unnecessary. This probably evoked certain feelings in P. A. Avdeev — he had become attached to it.

These differences led to the DM-SL block becoming practically a new block compared to the serial one. Even the engine itself and the in-tank devices underwent changes due to the altered temperature range of the liquid oxygen being loaded.

The Zenit rocket was fueled with "boiling" oxygen, while the block required supercooled oxygen. Engineering ingenuity was required.

The time came to hand over the DM-SL block to Sea Launch. D. Skumal arrived with a whole company for its acceptance. The block acceptance procedure included a review of what had been done not only on the block itself, but also on the development of its individual systems and units. They talked about the control system, the development of structural nodes, the types of tests of the block itself, and, of course, the cause of the DMZ No. 5L block's accident during the launch of the AsiaSat spacecraft.

On December 25, 1997, as part of the launch of a commercial satellite from Baikonur on a Proton rocket with a DMZ No. 5L upper

stage, the AsiaSat spacecraft was launched. The rocket performed normally. The first launch of the upper stage went without incident, but the second misfired literally in the first second after the “Launch” command. A disgrace to the whole world!

The Americans reacted calmly. “Well, it happens, technology is complex.” It’s no wonder they insure all launches. They don’t lose money. But we lose a lot: both our prestige and our money.

It was good that the second ignition, although 36,000 kilometers from Earth, occurred within the visibility zone of our ground measurement consoles. So, full telemetry was received. (Unlike the Martian variant).



Pavel Alexandrovich Avdeev

It was clearly visible how the pressure behind the oxidizer

pump in the turbopump unit increased and how its operation failed. After that, the failure of the fuel pump was also visible. The reason is clear — the engine is to blame. And then questions. Why did such a reliable engine fail?

I retrieved the results of ground tests during its development. Analysis showed that during bench tests, there were cases of engine non-start, and this was now observed at elevated liquid oxygen temperatures. After a certain temperature, this phenomenon became more and more regular. But it was far from the limits specified in the technical assignment. This meant that another reason had to be sought.

In such cases, innovations in design are sought. “The best is the enemy of the good,” said Sergey Pavlovich Korolev. He forbade making changes to a flying rocket.

The cause of the engine failure was found. It turned out that a so-called anti-friction coating was applied to the sealing rings for their durability and surface layer strength. The gap that could form between the TNA shaft and the sealing ring depended on the quality of the applied coating. The tolerance for the gap was only 0.15 mm in diameter, and with coating wear, it could reach 0.45 mm. We checked it on the stand. We started the engine with increased gaps, and it wouldn't start. The cause was unequivocally established.

Just think, the block is 36,000 kilometers away, and we find out that the cause of the failure is in tenths of a millimeter!

The meaning of this gap was that the “cold” component would hit the “warm” structure, boil (like splashing water on a hot pan), and its vapors would penetrate through these gaps into the inlet of the oxidizer pump, which supplied the component to the engine, but already with a high gas content. This led to flow disruption, cavitation, a drop in pressure behind the pump, and an emergency engine shutdown.

Again commissions, again reports to foreign colleagues, again measures. The most terrible of these was that the engine pumps had to be reassembled on an already fully assembled block. And this was a significant deviation from the standard technology.

So Viktor Georgievich Khaspekov had to explain for over four hours to American specialist E. Bill that this was the unequivocal cause, that we had modified the block without violating reliability requirements. The discussion was long and tedious. In the end, everything was settled.

In a solemn ceremony, the act of acceptance of the block was signed and approved by the General.

A month later, the second block was delivered. The blocks were to be sent to the base port on the SCS, which was still being

equipped with rocket equipment at the Kanonersky Plant. V. G. Aliyev was in charge from our side. Now marine assets were under his jurisdiction.

We had to transfer our blocks to St. Petersburg at all costs, and the “Southerners” — their rockets.

The outfitting of the launch platform took place in Vyborg, where G. A. Poryadin was the director. He received an order for his factory. The technical management of the rocket segment outfitting was carried out by Vitaly Nikitovich Pogorlyuk and Alexey Alexandrovich Shumilin.

G. A. Poryadin is a very active person. The technological process at the factory was well-established, but Georgy Alexandrovich had to again look for orders across the country and abroad. Orders were scarce. So he decided to sell part of his factory's shares to the Norwegian company Kvaerner, for which he later paid the price himself. A year later, the Norwegians relieved him of his position.

The SCS departed for Long Beach. The platform followed. The SCS went through the Panama Canal, and the SP (launch platform) — through the Suez Canal, the Indian and Pacific Oceans.



Signing of the first acceptance act for DM-51 block No. 1TL.

Standing: N. Maguire, B. Wilson, A. Tarasov. Sitting: V. Filin, D. Skuyal, R. Archibald



Loading of the upper stage onto the assembly and command vessel

DIGRESSION

It's rocking. I've never been on the water for so long, and on such a huge ship. Sea Launch is written on its side. We are heading to the launch point. The Pacific Ocean appears calm at first glance, but in reality, the wave height reaches one to three meters.

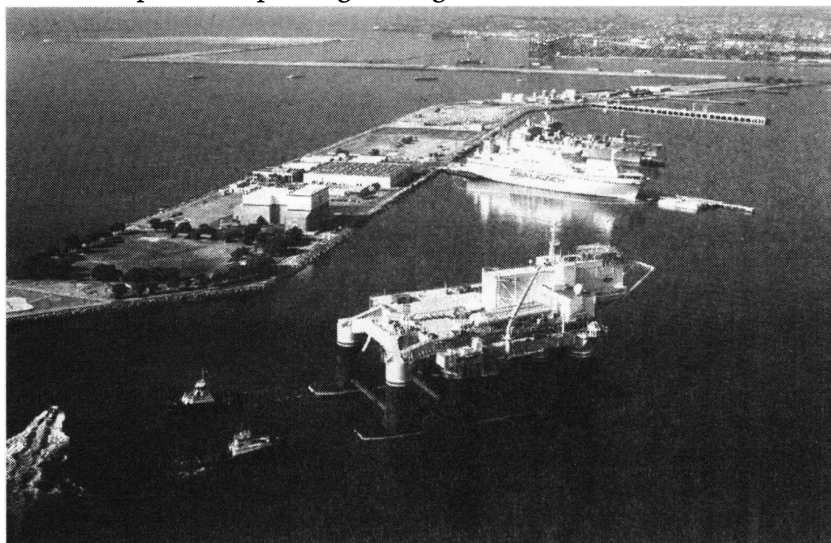
I have to get used to the rocking. On the first day, I wanted to sleep. I slept so sweetly that I caught up on a whole month's sleep. A cozy cabin. Wardrobe, bed, coffee table, sofa, desk, armchair, toilet, shower, sink. Everything necessary is there, even a window. Many cabins are without portholes, and people live in them in pairs.



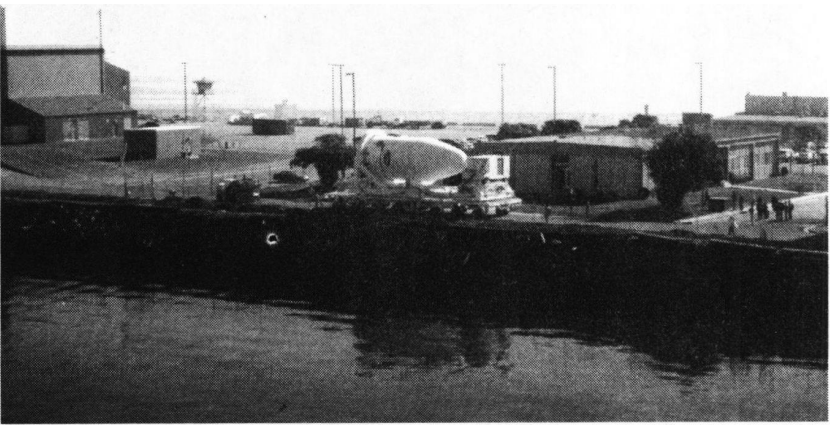
Assembly and Command Ship



Launch platform passing through the Suez Canal



Home port



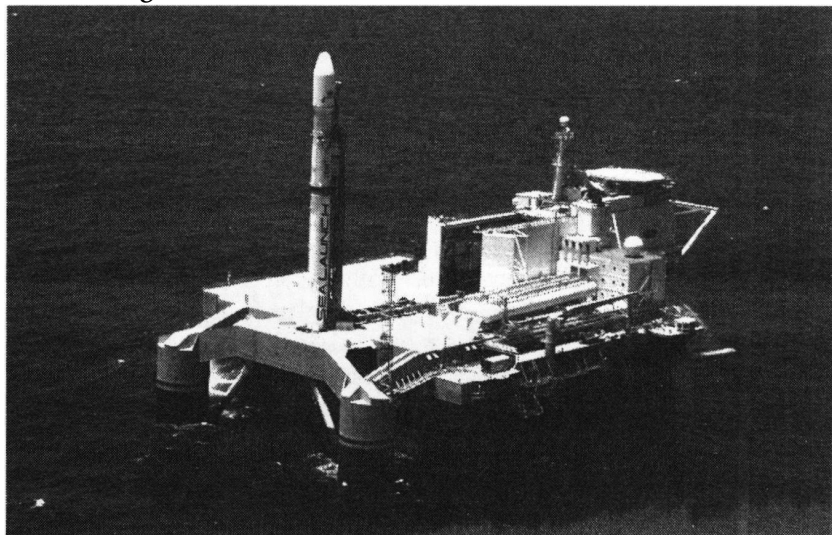
Home port. Transporting the space head section to the ACS



Launch platform. Rolling out the LV from the hangar to the launch device



Installing the Zenit-3SL LV on the launch device



Zenit-3SL LV installed on the launch pad



In the area of complex tests

So, everyone's conditions are different. But the mood is the same—to do everything possible to launch the first rocket from the sea. Many are already dreaming of it.

Six years have passed since the start of development. The composition of participants has changed. To my surprise and joy, I met old acquaintances: A. Ashby—he is now the president of Sea Launch company—and Emmy Berner, the very one with whom we developed the company's emblem. She was also incredibly happy to see me and, surprisingly, without hesitation, hugged me like a relative and kissed me on the cheek. How unlike Americans, reserved and sometimes even arrogant. But here, such a simple gesture. She spoke something quickly, I answered her. We both laughed merrily: neither she understood Russian, nor I understood English.

It's rocking. I remembered the farewells. The platform left a day earlier. The pier was empty, except for a few people who remained from our expedition on shore. Simply, routinely, as if this happens every day. However, the day before, local television showed our ships and explained something to ordinary taxpayers.

It's rocking. The ship is huge. Over 200 meters long and about 32 meters wide. It sways slowly and majestically on the waves, and only the bulb in front dives deep, then surfaces.

It's hard to imagine that this is a floating spaceport. Only the launch itself is missing. It floats nearby. On the water, it looks like a huge dinosaur, in whose womb, awaiting its hour, lies the Zenit rocket, with my native DM block already attached to it, along with the payload block. The payload is a mock-up for now, but later...

On the floating spaceport, the ACS, everything is like in the steppes of Baikonur. There is an assembly and testing facility, a

fueling station, a command and telemetry reception center, an automated rocket launch control complex, a hotel, a dining room, a cinema, etc.

Three hours before launch, not a single living soul will remain on the launch platform. And it, like a good remote-controlled toy, will obey commands from the floating command post.

It's rocking. How many years have passed! During this time, from simple judgments and first project sketches, these amazing floating facilities have been created, allowing the launch of the rocket and space complex. How many people are involved in the project, how many nerves have been spent, how many disputes, how people "got used to each other." It seems everything has been tested, worked out, checked, and now it's moving towards the finish line. Everything inside chills as you imagine... Better not to think about the bad. And if the opposite! It's also better not to think about that in advance.

It's rocking. At the beginning of the project, we couldn't even imagine that during the launch, our General and the Generals of other design bureaus wouldn't be there. We are sailing, no—we are going, without them. And only by phone do you feel Yuri Pavlovich's excitement. He asks questions: Is everything done, checked, tested?—Questions, questions, questions that we ourselves asked and ask ourselves a thousand times a day.

It's rocking. It seems I've gotten used to it. Thoughts about the DM block don't leave me. How is it there, in the rocket, has it settled in, will it not fail? It's too late to fix anything. That's when you become superstitious. Yes, at Baikonur, another block "married" with "Proton" and is waiting for its hour to launch another, the fourteenth, foreign spacecraft. Just think: the fourteenth! And only once did the block not work properly, failing to deliver the apparatus where it needed to go. Such misfires happen. It's good that they figured it out. Now it won't happen again, or rather—it shouldn't happen again, and then, as fate wills it.

It's rocking. Thoughts, thoughts, memories. How much we've trudged through during this time. Not only in technology, but also in life. How our thinking, our views, our relationships have changed. All mass media have been hammering the American lifestyle into us in recent years. Not a day went by without us hearing English speech on all TV channels. Races, murders, sex, and happy endings. And so from morning until late at night. You involuntarily start to think differently.

It's rocking. You understand better and better that a good mood gives birth to a feeling of satisfaction from what has been created in

life. You want to leave your mark on earth, a mark of creativity, a mark of love for your work. I remembered the first launch of my native DM block, and it has already worked more than two hundred times. It has been modified several times. The latest modification is in the “Sea Launch” project. Time flew by quickly.

It’s rocking. I compare people’s relationships to myself. We came to the bridge. The captain is Norwegian. He approached. We greeted each other.

“Would you like me to tell you what’s in this bridge?” he asked me and Gudilin V. E.

We nodded our heads gratefully. It’s good that there’s a translator nearby. He began to explain in detail what kind of communication they have, what navigation equipment is in the bridge, how the radars work, the fire extinguishing system, etc., and all this with a smile, benevolently.

And I involuntarily compared it to my last flight to America with Aeroflot. I approached the cockpit of the Boeing-767.

Interesting. The senior flight attendant ran up:

“What are you doing?”

“I wanted to ask.”

“Nothing to ask. Go to your cabin,” all this in a commanding tone, “if you argue, I’ll hand you over to the police upon arrival.”

An hour later, she approached me:

“May I check how you filled out the declaration?” she asked in an apologetic tone, “if you made a mistake, there will be trouble. It’s better to correct it in advance.”

Apparently, she had a change of heart. But she didn’t dare to apologize for her rudeness. The declaration was in order.

Apparently, the rudeness accumulated within us over many years sometimes still bursts out. And one could re-educate oneself, especially those who serve passengers. You compare, and it becomes shameful. Ashamed not for the flight attendant, but for myself, for all of us. I think such things need to be quickly overcome and forgotten. When will we learn not to offend other people?!

It’s rocking. We are sailing.

THE VOYAGE

Chronicle: Departure from the port of Long Beach of the Launch Platform (LP) on March 12, 1999, at 9:30 PM.

Departure of the Assembly and Command Ship (ACS) for tests on March 13, 1999, at 8:30 AM.

Departure of the ACS to the launch point on March 14, 1999, at 2:30 AM.

The Launch Platform left the port for the launch point earlier. The platform's speed was lower than that of the ACS, so the decision was made for the ACS to depart later.

In addition, issues with the thrusters' operation appeared on the ship. The Norwegians were repairing something in port. But they couldn't go to the launch point without checking everything near the shore.

There was a long debate about whether the platform could be released alone, without the ship, and whether to return to the home port after the tests. Logically, the platform should go, and the ship, if necessary, would return to port. It would catch up with the platform anyway.

The tests were successful.

Captain T. Hansen promised to catch up with the platform within 24 hours.

The thrusters on the ACS played a very important role. At the launch site, when working together with the platform, it was necessary to maintain the ship's orientation and position relative to the platform quite precisely.

The ships would position themselves side-by-side at a distance of 30 meters. A telescopic gangway was extended from the ACS to the platform, allowing specialists to cross to the platform for work and tests. For this, the engines, both in the bow and stern, precisely executed dynamic positioning commands. During the launch itself, the ships would separate to a distance of about 4.5 kilometers, their relative positions also having been agreed upon in advance. The platform remained unmanned, and all its control was carried out via the platform's antennas through a radio channel, which required a specific orientation of the ships. The bow thruster caused complaints. Its operation produced significant vibration. DM-SL Block № 3L, which was located in the bow of the ACS, underwent additional vibration tests. Perhaps this is why we received a comment about the engine's steering gears.

The transfer of people from the ship to the platform could be

carried out not only via the gangway. For these purposes, an elegant (no other word would fit) seven-seater helicopter, housed in a special hangar, and a boat on board the ACS were intended. As it turned out later, the helicopter was the most suitable means of personnel delivery. It performed up to 30 takeoffs and landings per day.

A day passed. On the huge ship, the pitching was strongly felt. Big waves. The platform appeared on the horizon. We made contact. It turned out that not everything was in order on the platform. Muffled sounds appeared in one of the oxygen refueling tanks. A. A. Shumilin reported this to the ACS. Forward movement was interrupted. The cause needed to be determined. This was no joke. Cryogenics must be handled with extreme care. Many hypotheses were built, but it was difficult to imagine what caused these sounds from a phone conversation. The assumptions varied. Poor fastening, disruption of internal connections, liquid hammer. One thing was reassuring: the pressure in the tank remained stable.

A team from KBTM, led by V. G. Makarychev, was delivered to the platform by helicopter. I immediately recalled his speech at the first OTR meeting.

The team remained on the LP until morning. A solution to eliminate the sounds was found. The tank was additionally secured, and the platform was tilted to its starboard side by approximately one degree. The sounds disappeared. One can only assume that the support of the tank's inner vessel had broken, and during pitching, it was hitting the outer wall. But this would be dealt with after the launch.

The voyage continued. I received pleasant news from Moscow: "Asiasat" is in orbit. Well done, Konstantin Konstantinovich Popov, he corrected my mistake made in December 1996. We paid for the "Asiasat" accident.

The moment came when the captain said that we would be able to reach the launch point together with the platform, even if we made a small detour to Christmas Island to pick up a spare instrument for the rocket.

Our Ukrainian colleagues were very concerned about the operation of the PH control system. The memory of how a rocket was lost due to a control system failure was still vivid. The Zenit rocket launch was carried out from the Baikonur Cosmodrome, and during the operation of the second stage, two channels (out of three) in the control system failed one after another, after which it issued a command for emergency engine shutdown.

During tests of the Zenit-2B rocket on the ACS, a defect was found in one of the control system's command instruments. It was

replaced with an instrument from a neighboring rocket. Verification tests passed without issues. L. A. Gribachev, as an experienced test engineer, was constantly under tension. The entire voyage could be in vain if this instrument also failed during the final tests. A. V. Agarkov shared his concerns. They went to consult with the Sea Launch mission management. It was decided to deliver a spare instrument by plane to one of the islands in the launch area, and the ACS would pick it up on its way to the launch point.

I like the Americans' ability to think through every detail in each operation. Sometimes you wonder how much more can be said about the same thing. But then you analyze it, and it's right: you have to look at the issue from all sides. Meetings are democratic, everyone is given a chance to speak, everything is calm, without squabbles. Any proposal is discussed, and as a rule, a decision is made that will increase the reliability of the product, even if only slightly.

So it was here. A. Ashby gathered all interested parties, listened to everyone. Indeed, everyone unanimously supported the idea of calling at Christmas Island. The decision was made. They left the platform on its route, and they themselves turned towards the island. The instrument was delivered to the island by plane, and then by boat to the ACS.

Time was pressing. The anchorage was planned for three hours. But A. Ashby decided to invite the governor as a guest. He was looking far ahead. The island is only 240 miles from the launch. You never know, it's better to establish acquaintance with the local authorities. Two helicopter flights, and the delegation was on the ship.

Only the Minister of the Republic of Kiribati, A. Taekiti, was in a shirt, trousers, and shoes. The others were in shorts, flip-flops, and some even barefoot. The women were in light dresses and also in flip-flops. Everyone spoke English well. Their dazzling smiles and snow-white, even teeth were memorable.

They were shown the ship. A. V. Agarkov told them about the rocket, and I told them about the upper stage. Questions were asked by one of the visitors, who looked like an Indian. As it turned out later, he was educated in England and closely followed technological developments. On the islands (and we thought it was one island) there was telephone communication, television, and on the main island, even a higher education institution. The population was about 100 thousand people. Six



Second from the right, Minister of the Republic of Kiribati A. Taekiti

policemen. When asked why they needed police, they replied: to calm tourists. The main religion is Catholic, and they have their own language. There is no industry. The settlements on the islands are called "Paris," "London." I wished them to name at least a tiny village "Moscow."

The main occupation of the islanders is fishing. According to them, there are many fish here, and the most exotic ones are caught, which attracts tourists. Lunch was solemn. Guests were presented with souvenirs. The helicopter returned the guests to their homeland.

Our command ship, as they say, moved at full steam to the launch point.

To our satisfaction, the platform was already in place and in working condition. The working condition of the platform differed from its transit condition. The platform submerged into the ocean to a depth of about twenty meters, with surface waves having practically no effect on the platform, not rocking it. This was very important for the rocket, because during launch, when the rocket is already in a vertical position, its attachment to the platform is practically only at the end face. In this case, pitching could cause unacceptable loads at the lower end face of the rocket. This was, firstly, and secondly: a slight immersion of the rocket into the launch device with a small gap also required a strictly vertical position of the rocket during launch to avoid collision with the

launch device. The ballasting of the platform precisely allowed this to be done. A tilt relative to the vertical of no more than 0.8 degrees was guaranteed.

On March 25, at 6:30 AM, work began to bring the ACS systems and units from transport to operational position. The work was completed around ten in the evening.

The morning of March 26 — the second pre-launch day. The day of final checks. Tomorrow is the launch. How will it go?

A slight delay with opening the gates, and then the erector slowly moves the rocket out of the hangar. It approached, locked into place, and began the slow ascent of the rocket to a vertical position. It was raised.

Report from the platform:

— The thermostatic sleeve has detached.

It's impossible to secure it in a vertical position; the rocket needs to be lowered.

Permission from Mission Director D. Wood received:

— Lower the spacecraft.

The boom slowly crept downwards.

Various thoughts race through my mind; we've become so superstitious. One consolation, though: the harder the preparation, the more successful, as a rule, the flight. "We'll see," I reassure myself.

The sleeve is secured. Ascent again. The delay lasted a whole hour. That's it. The rocket is installed and secured, the lines are connected.

Over the headset, the mission director's voice:

— The monitor shows that your upper clamps are open. Is that how it should be?

— We'll figure it out now, — V. G. Aliev replies.

Oh, the horror! A dry rocket cannot stand on the launch device without upper support. The upper clamps of the erector perform this role. On command, the clamps were brought together, then opened, and brought together again. A query to V. G. Makarychev: What happened? In response: We're figuring it out.

The clamps not only operated without authorization but also tore off the drain covers on the oxidizer and fuel tanks of the second stage.

The Dnepropetrovsk team began to analyze the situation. It seemed nothing terrible. It was good that during the operation of the clamps, Anatoly Vasilievich Agarkov had left the control room and did not see what happened himself. He probably would not have avoided a heart attack.

Everyone understood what was at stake with this launch.

Total delay 5 hours. Fortunately, all subsequent tests, especially the ill-fated KNSG (control set of launch readiness), passed without comment. It was late. It was already dark when the work was completed.

Again, comments on the ACS azimuth engine. The gangway cannot be installed. The helicopter does not fly at night. Thirty people had to be left on the launch platform until morning. They had to sleep without any comfort. The head of DM operations, V. E. Gudilin, also remained on the LP.

I liked working with him. He never complained, defended the interests of the block in all situations, cherished the block like his own child, carefully monitored the servicing systems, and loudly criticized their developers at meetings. He was confident in the block.

“There are no comments on the block,” he liked to repeat at various levels. It made me a little uneasy: I hoped he wouldn’t jinx it before the launch. But that was just to myself — superstition.

DIGRESSION

Perhaps there are laws in nature that are difficult to understand. Maybe it's a factor of our upbringing. From childhood, we are taught to do everything well, conscientiously. To do it in a way that pleases ourselves. That's how we work and instruct our subordinates to follow these rules. But to be noticed by superiors or partners, this rule doesn't work. You need to show how complicated everything is. Even if it's just screwing in a bolt. You can talk about this for a long time and colorfully describe overcoming all difficulties. For example: the bolt must have a thread that matches the thread of the hole; have the necessary thread length; the thread must be deep, without burrs; the bolt head must have unstripped facets, an external or internal surface for connecting a wrench; the thread pitch must be checked with a tool; the chamfer must allow for the removal of stress concentrators; the materials of the bolt and nut must be such that the thread does not "seize," etc. And this is all about a simple bolt. What about a mechanism, or an aggregate, or a device? You can talk all day about the importance of one parameter or another. Scare the management with a loss of reliability of the aggregate (device), justifying missed deadlines. Ask for additional people, computers, finances for contracts with co-contractors. And they are forgiven for everything, not even scolded. They forget what efforts it cost neighboring departments to complete the work on time, and as for quality, there's nothing to say. But their work is paramount to them. They are not given people and it is believed that their work is easy, but these others! Oh, how hard it is for them!

In reality, they overslept the deadlines, they should be punished. But no! They become heroes, they are talked about everywhere, they are in plain sight. They created difficulties themselves and heroically overcome them themselves.

There were so many troubles with ground systems, but they, the ground crew, turned out to be the heroes. They provided, they won.

Even the three-attempt ascent of the rocket to the launch pad was called a heroic event by one of them. That's how much they value themselves! But it would be better to ask them: why don't the systems they created work as they should, maybe deduct the money they were paid for the devices and systems from them. Yes, there are, probably, laws of nature that we do not understand.

Ask them—the culprits—to pay for the nerves, wrinkles, and

gray hairs of people who worked conscientiously and are forced to worry about their products when they are mocked. That would be fair.

LAUNCH TIME

Standing on the equator at 154° West longitude.

A clear morning. Light wind, 2 Beaufort. 8:15 AM local time. Six-hour readiness announced. This means six hours remain until launch (CP — “contact of ascent”). Work is underway to prepare the technological equipment complex for fueling and launching the launch vehicle. An unexpected stop due to an unauthorized launch of the PSP (pre-launch preparation program); the launch cyclogram had to be halted.

At 10:25 AM, the turbodetander of the air temperature control system stopped. The PSP had to be restarted. Systems are being reset to their initial state. The scheduled launch time shifted by approximately three hours. The repeat command to start the cyclogram was given at 12:10 PM. This still allows the launch vehicle to be launched within the agreed four-hour launch window.

Senior steward Ove Rosenberg is ready to do anything to make us comfortable. Chocolate and food are served. The program is proceeding normally, without issues. A certain relaxation has set in.

Calls came from Moscow. Everyone is tense. One rocket, and how many people it attracts. It seems that by their sheer will alone, it should fly.

— *Cooling of the launch vehicle's oxygen fueling systems has begun,*
— the operator's voice.

To ensure that conditioned component, not its vapors, enters the oxidizer tank, ground systems are flushed with liquid oxygen. The flushing ends, and only then is permission given for the component to enter the tanks.

The weather forecast is within tolerance. And it would be too late to cancel the launch anyway. Evacuation from the launch platform continues. Warm helium is supplied to the board, purging of the screen-vacuum thermal insulation of the oxidizer tank block, thermostatic control. Personnel evacuation will be completed in 30 minutes.

— The launch vehicle kit is ready for fueling, — reports L. A. Gribachev, head of work on the space launch vehicle.

Everyone is in place. The silence of anticipation. A readiness check for the evacuation of the “red team.” These people are the last to leave the launch platform. After that, everything happens automatically.

In the center of the Pacific Ocean, far from shipping lanes, stands this heap of metal. Miracles literally happen on it. Valves

open and close, fuel components are pumped, the rocket stands rooted, awaiting its fate. People 5 kilometers away control this complex marine complex. The control system precisely holds the platform at the launch point. The Americans guarantee accuracy to within a few meters.

— The onboard digital computer is ready, — reports V. E. Gudilin. He is on the “red team.” — We’re leaving.

We were very afraid of this mode. The fact is that during its checks, the computer often froze, and everything had to be repeated, and there were similar cases during factory tests. NPO AP specialists could not explain what was happening with their system. Why the onboard computer does not deploy the onboard cyclogram, which means that all launch systems do not receive the command to turn on. The block will become uncontrollable — a “chunk.”

Again, V. E. Gudilin is nearby, on the other end of the line are N. I. Kovzalov, V. N. Panarin, K. K. Popov. All the old guard. Ten years have passed since the launch of the Energia launch vehicle, and here is another grand project. You feel calm when they are around.

The first — Valery Geidarovich Aliev — looks calm. Reports to the mission director are confident, convincing. The Americans and the mission director react with understanding to our delays.

Overall, the atmosphere is businesslike. V. P. Legostaev sets the tone. It’s unclear what’s happening inside him, but he doesn’t betray his anxiety, only making notes about failures in his notebook.

— The engine of the boat that the “red team” was supposed to return on has failed. Another boat with the SCS was sent for them, — the mission director announced.

Such things happen! We will wait for their return. The program is running its course. It became stuffy in the hall. Personnel from the launch platform arrived. Everyone crowded into the control room. Interesting. The current parameter values are displayed in real-time on three huge screens. The sequence of pre-launch operations on the mimic diagrams of ground and onboard fueling systems gives a general picture of the processes occurring on the launch platform. The boat with the “red team” is visible on the TV screen, waiting for help from the SCS.

— Telemetry from the launch vehicle is being received, — reports V. G. Aliev to Mission Director D. Wood.

— Received, — he replies.

The screen shows the boat with the SCS going to rescue the “red team.” Everything is fine. They are going (sailing) back.

Three hours before CP, the launch vehicle is ready for liquid

oxygen fueling.

— Onboard computers are ready for liquid oxygen fueling.

The situation remains calm. But tension is approaching. This is visible on the faces of all present.

Rocket launch. How many stations, systems, navigation and communication satellites are involved. All for one thing, for success.

Powerful ground and floating radio engineering systems are involved in this project. V. G. Kravets and I. E. Brodsky overwhelmed everyone with questions and messages.

— Begin oxygen fueling of the rocket, — again the first on the headset. This is an order to the operators.

Again, waiting. Time stretches. This is especially felt during commercial DM block launches between the first and second ignitions.

The chief designer of “Zenit,” A. V. Agarkov, studies the fueling cyclogram for the umpteenth time. It has long been in his head. But it doesn’t hurt to look at it again at the command to fuel. An urgent report to his General S. N. Konyukhov. He is in Long Beach. A live report is being sent there.

Sea Launch invited many Generals from Russia and Ukraine to the launch, invited those from Boeing who started the project, and Norwegians also arrived. Only our General could not fly. A shareholders’ meeting was held literally the day before. He didn’t make it to the launch, observing from the Flight Control Center in Korolev. CNN promised the MCC a television report. I think this is not the same for our General. How he wanted to be here! After all, the project is his “brainchild.” He created the project during the “turbulent times” in the country. The last grand project of the XX century.

Two and a half hours until CP. Silence.

— Transition to low-rate oxygen fueling of the launch vehicle, — reports L. A. Gribachev.

Forward, only forward. Probably everyone shares this opinion. The project was worked on for five and a half years. It took ten days to reach the launch site. The most unknown and least studied point on the Earth’s equator in the Pacific Ocean was chosen. The nearest island is 240 nautical miles away. Thanks to the request of the Ukrainians, we visited nearby islands (Christmas Island) and even met the local governor. We went to the island for one instrument, delivered here by plane, which should be in reserve for the launch of the launch vehicle. What if the same one on board fails? Water all around. Ocean. It seemed there was no wildlife. We asked each other:

— Are there fish here?

— Yes! And what kind! Flying fish. — At first, I didn't believe it. It seemed that a stone was thrown from our ship, then another. I saw: escaping from the ship, fish were fleeing, at first they were solitary, then they came in schools, just like sparrows in Russia, only silvery-white. They flew about thirty meters and then dived back into their element. This can be observed for hours.

— Ready to perform operations for fueling the launch vehicle with propellant, — a new report is heard.

The process of preparing the launch vehicle for launch is on schedule.

In Moscow, it's already half past two in the morning. Everyone is waiting, and my friend V. V. Morozov can't sleep either; he's had a tough few days. The math was worked out until the very last moment. It's good that there are faxes and email. You can transmit the contents of faxes with software thousands of kilometers away, into the open ocean, in a matter of seconds — it's a miracle of the twentieth century.

— Second stage spherical tanks are submerged.

This means that the liquid oxygen level is above them. Now they can be filled with helium. The lower the temperature of the tanks, the more gas can be pumped into them. The struggle for payload mass.

The "Zenit" rocket, developed during the Soviet Union, embodied the latest achievements of socialist industry and creative thought. The world's most powerful liquid-propellant first-stage engine and an onboard computer that is not inferior to foreign ones, and the manufacturing technology of the casings, even fifteen years after the collapse of the Union, is still at the forefront. What a foundation!

— 2 hours until CP, — Valery Geidarovich Aliev's voice is calm, followed by a report to the mission director on what is happening in the rocket segment.

Waiting.

During the transit, sharks appeared near the side of the SCS. I remembered how two days ago S. I. Tyagun dragged me to the stern, saying: "There are many of them here."

The sharks looked like airplanes in the water. Large front fins give these beauties the appearance of crosses. Their white belly and white fin tips give them extraordinary beauty in this turquoise ocean. None of us had seen sharks before. Everyone who wasn't working gathered on the deck. There was excitement. You had to work to catch a shark. Homemade hooks, pieces of meat on ropes were thrown overboard. First one, then two, then as many as seven sharks began to circle near the stern. They ate the meat, but the

hooks couldn't hold, they straightened out.

— Begin fueling the rocket with propellant, — another command was given.

I don't want to think ahead. It's better to think about something else. You can't help your block anymore.

Shark fishing was unsuccessful. Some of them swallowed the meat, got hooked, were even lifted out of the water, but a tail whip, and they were back in the ocean. Captain T. Hansen calmly watched what was happening with curiosity.

— And they caught one on the platform, — was the remark.

I saw his surprised look, he clearly had something in mind.

In the evening at the operational meeting, the Boeing security representative

delivered a whole tirade about this, that one should not disturb the natural balance in nature, feed, and especially not catch fish. It is forbidden. By whom?

In the morning, the crane cable was lowered, with a large hook and bait — meat — on it.

The captain's cunning gaze. It probably bothered him that they caught one on the launch platform, but we didn't. The sharks didn't keep us waiting. One grabbed the bait and hung there. They lifted it onto the deck. Powerful tail thrashes didn't allow it to free itself from the deadly hook. Photos, movie cameras. The satisfied captain took a knife and sliced the fish open. We understood there would be fish soup, and the fish was sent to the galley.

And in the preparation cycle, a small alarm.

— Drain covers did not open.

— We're figuring it out as we go. Indirect parameters indicate they are working.

— No signals from the covers.

— What's easier: repair them or simulate opening on the console?

— Simulating on the console is easier.

— Fueling has begun at a low flow rate.

Just yesterday, everything was played out, and here you go — there's a remark.

Everything new needs to be worked out. And here is such a complex.

Remarks, corrections, and we move on.

Yesterday, the rocket was installed on the launch pad three times to eliminate various shortcomings and malfunctions. Finally, my turn came. The first report on the start of the upper stage preparation:

— Oxygen fueling of the upper stage oxidizer tank has begun.

Attention! We look at the mimic diagram. Our guys literally glued their eyes to the monitor screens. For these minutes, they are here to warn and correct any emerging anomaly in time, should it appear. But we don't want to think about that.

It's not the first fueling, but the tension is always present. Expect surprises from cryogenics. The main thing is the component temperature. The lower, the calmer and better.

Again, we wait.

The "Southerners" are dealing with the remark about their covers. No all-clear given. This means they will handle it.

Slow kerosene fueling. For some reason, the flow rate is low. The operators figured it out. The sensors are not providing objective information.

— Bubbling activated.

This is an innovation. On "Proton," fueling is only done with thermostatic control.

"Warm" oxygen is replaced by "cold" oxygen. Practically until the service tower is retracted. Fueling also happens from the tower there.

In the "Sea Project," there is no tower. There is only the erector boom. It is impossible to perform thermostatic control through the launch vehicle's "heel." So our theoretical engine designers B. A. Sokolov, V. G. Khaspekov, and A. V. Sorokoumov came up with a way to lower the average mass temperature of the component by two degrees by mixing oxygen in the tank using helium. They not only developed but also refined this procedure on a special block.

— One hour left until CP.

— The manifold valve didn't open (something in the "ground").

— Switch to manual.

Upon reaching the "minimum level," oxygen supply is temporarily stopped because one valve failed to operate. The operator managed to manually open the valve, and fueling resumed. During the approximately 2.5-minute stoppage, the oxygen in the fueling line warmed up by 3.4°C. After fueling of the oxidizer tank resumed, 430 liters of oxygen at minus 189°C were supplied, followed by about 300 liters at minus 193°C. There is no bubbling. A layered cake is formed.

— Fueling has started.

— Upper stage fueling completed.

Phew! Already easier. All that's left is to fill the spherical tanks with helium.

The rocket is being refueled.

V. E. Gudilin, as always, is an optimist:

— Nothing terrible: a 2.5-minute stop didn't spoil the oxygen

temperature.

— Still need to check.

E. A. Lukyanova and A. M. Egorov are writing, calculating, analyzing. I'm waiting for the report. It turned out that the average mass temperature at the end of fueling was minus 192.5°C, i.e., the increase in average mass temperature due to component heating in the pipe during the stop was about 0.3°C.

The temperature is good. Like at Baikonur. Well done, engine designers, they constantly cared for their brainchild — the beloved 11D58M engine.

Analysis done, report submitted, ready to fly.

Call from the General (around 4 AM in Moscow):

— How are things with you?

— The block has been fueled. 27 minutes until launch.

— There's confidence. Don't tremble.

— There's confidence, but we're trembling.

V. P. Legostaev nods in agreement.

The erector boom lowers, freeing the rocket.

17 minutes. The erector will go into the hangar. I want to jump ahead.

Patience.

Boom at zero. Hydraulic supports retracted.

— Erector moving into hangar.

— 10 minutes until CP.

— Replenishment finished. Thermostatic control stopped.

— Rocket spherical tanks fueling completed.

— Erector in hangar. Hangar gates closed.

— 4 minutes until CP.

— "O" drain completed.

— 3 minutes until CP.

— Fueling device uncoupled, protective covers closed.

— Transition to upper stage onboard batteries.

— Tanks pressurized.

— 1 minute until CP.

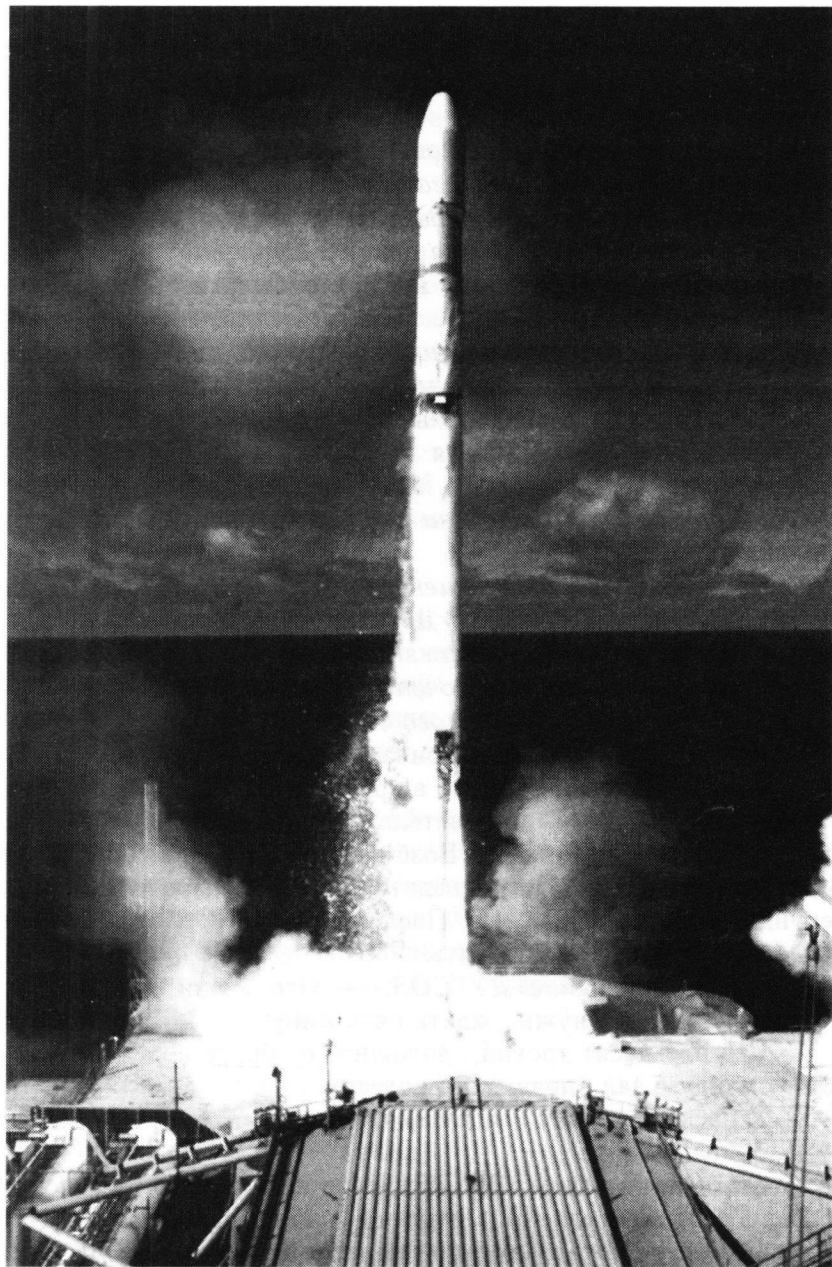
The tension is enormous.

— Tray cooling is on.

— 5! 4! 3! 2! 1!

Launch!

The Zenit-3SL launch vehicle was launched on 28.03.99 at 01:29:59 (UTC) or 4:29:59 (MSD) or 5:29:59 Moscow summer time. The screen shows how easily the rocket lifts off the launch pad.



First launch. First seconds of flight

— Contact of ascent.

Everyone jumped up from their seats to look at the screens.

— 20 seconds. Flight is normal.

Noise in the headsets.

V. P. Legostaev broadcasts what is happening to Yu. P.

Semenov:

— First stage engine throttling.

— Second stage steering engine ignition.

— Second stage engine ignition.

Everyone who was free gathered in the control room. It was stuffy, the air conditioners couldn't cope.

— Fairing jettisoned.

— SOZ propulsion system pressurized — this is ours. Our block came to life. The command went to the pyrovalves, and gas from the spherical tank entered the cavities of the oxidizer and fuel tanks. This is clearly visible via telemetry.

— Command for main engine throttling passed.

— Main engine shutdown.

Another hundred seconds of flight. The steering engine will last. Confidence in success is already visible on the faces of the "Southerners."

— Command for steering engine shutdown.

— Head unit separation.

Noise, hubbub, applause. Shouts of "hurrah"!

Valery Geidarovich shouts into V. P. Legostaev's receiver:

— Yuri Pavlovich, it flew away!

Everyone's faces are filled with joy. Excitement from success overflows. V. P. Legostaev calmly (outwardly) conducted the report to the General to the end. Fractions of a second seem like an eternity. The last stage. It's ours, surely we won't fail? No. It can't be.

— SOZ propulsion system ignition, — This means there is axial overload, now we have to wait five minutes.

— One hundred fifty-three, report on adapter jettison, — I give the command to the flight control room.

— We have no information. We will now request the Moscow MCC.

— Request it.

Wait. Again, wait. These minutes turn into hours. It flashes through my mind: "This is a reassembled engine.

The General didn't want it to fly first. He was convinced that everything had been worked out, and testing was confirmed by the flight in December 1998. V. G. Khaspekov and B. A. Sokolov convinced him. They had absolute faith in their engine. They did indeed reassemble the engine that is flying now. During one of the commercial spacecraft launches, the engine failed to ignite a second time. The cause was determined.

Increased clearances in the floating sealing rings of the turbopump unit. It was necessary to delve into the very heart of the engine, and it was welded to the block. A special technology was developed, workers were trained, the methodology was refined on a

single engine, then on the block. It concluded with hot-fire tests. So their confidence was complete. But perhaps a tiny worm of doubt appeared inside.

Before my departure, when signing the final conclusion on the block, the General asked:

— And here, we have a reassembled engine, don't we?

— Reassembled.

He pondered.

— We've already flown with one like this (meaning a reassembled one), haven't we?!

— Yes, in December. If you wish, I'll express my opinion again. I'm confident in the engine. I trust it more than those we approved based on analysis results.

— And what else, maybe it can still do it.

— Nothing.

Now, in these five minutes, everything flashed by at a furious pace. These assurances of the engine's reliability, that it wouldn't fail.

When will these endless minutes end?

— Main engine ignition.

Someone shakes my hand. Without looking, I brush them off.

— Take the phone, — A. V. Agarkov shouts, — S. N.

Konyukhov wants to talk to you.

— I can't.

— Combustion chamber pressure is normal.

I calm down a bit. The engine should run for a little over six minutes the first time.

— No telemetry from TDRSS — the American satellite through which information was received from onboard.

?!

What is it?

— One hundred fifty-three. Did you issue the shutdown command?

— No. Sharp loss of telemetry.

— Telemetry lost, — V. P. Legostaev calmly reports to the General, — we are investigating, as soon as it reappears, I will continue the report.

Thoughts race like mad. The sudden disappearance is especially frightening. This happens in case of...

No.

Don't.

Patience.

Quick negotiations with the Americans. I. E. Brodsky found out that they also lost telemetry.

— Everything should be fine, — I constantly repeat to myself.

A chill ran down my spine. I can't stand it. I run to the ACS room (automated flight control system). Information might appear here fractions of a second faster.

— We'll enter the TDRSS visibility zone in ten minutes, — says V. G. Kravets.

V. P. Legostaev is here too. The room was closed. Over the loudspeaker, V. G. Aliev asks Vadim Georgievich Kravets what happened. Asks for a report. Questions and answers are irritating.

— Turn off the loudspeaker. There are headsets, — I can't stand it.

We switched to headsets. Waiting for the communication window. The Americans are counting money. They won't order extra minutes. The pleasure of using satellite communication is quite expensive. That's why they ordered a specific time, and with pauses.

How I want to know what happened a minute and a half before the engine stopped working. It would be good if it was a telemetry glitch.

— Signal from TDRSS, — Yu. G. Tsyplakov's voice is encouraging.

— Block parameters are normal.

That was a close call.

— How much time until the second launch?

— Approximately seven minutes.

These minutes again. It's not the first launch, but I still can't wait calmly. I know everything has already been done. You can't help the block. Everything is already predetermined. But how? I try to think about something else. It doesn't work. It flew far away.

Now it's somewhere over thirty thousand kilometers from Earth. But the further it is, the stronger and stronger your thoughts are drawn to it. The block takes them completely.

— SOZ propulsion system ignition.

Second ignition. How is it? In the last three years, we stumbled twice on this. Another five minutes. The "layered" cake in the oxygen tank comes to mind. — No, everything is clear here, — I reassure myself.

— Main engine ignition.

I look at the screen. The combustion chamber pressure is stable. Slowly, the tension begins to ease. We'll make it. After all, it held out for six minutes, my dear. I think it will hold out for the last ignition too.

— GKP, — this means the engine has shut down.

— Calculated operating time. That's it. The moment comes

when there's no mood, you just calmly wait for the spacecraft to separate. Only eight minutes.

— Spacecraft separation!

That's it! Inside, emptiness, indifference.

I congratulate the General by phone, and he congratulates all of us.

V. P. Legostaev calmly (outwardly) brought the report to an end.

Announcement over the loudspeaker:

— The Demosat spacecraft is in orbit!

Applause is heard: it's from the launch control room.

The block did not fail. Thanks to it, and that means to everyone who manufactured it, tested it, everyone who was here, and those who remained in Moscow and other cities.

The working rooms are empty. The block in orbit still needs to operate for several hours. But those are different minutes. The main task is done. The flight mission is accomplished. The apparatus is in orbit. Now the block needs to be moved away from it so it doesn't interfere. The SOZ propulsion system engines will do this. The guys will still have to sweat during this time. They will report.

There is no longer any doubt about the success.

Over the loudspeaker:

— Messrs. Filin and Gudilin are requested to come to cabin No. 282.

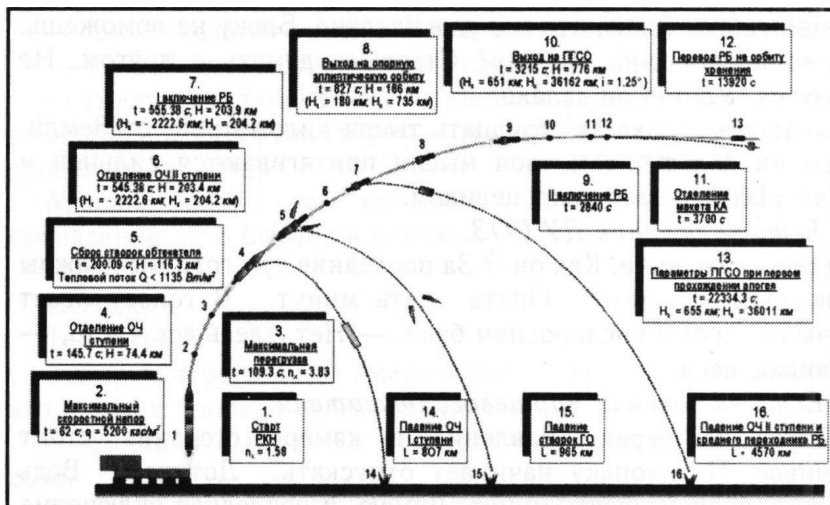
A. V. Agarkov congratulates.

— Let's go together. They probably just didn't call your name.

In the cabin were V. P. Legostaev, A. A. Shumilin, V. G. Aliev. We entered. It wasn't hard to guess why we were called. A bottle was poured. Tradition is tradition. Then we went up to the VIP room. We celebrated with the captain and the management of Sea Launch. We talked with A. Ashby. We remembered how it all began. Yu. G. Tsyplakov brought the "format" for signature, which indicated the accuracy coordinates for insertion. They were an order of magnitude better than required. A. Ashby and B. Beimuk solemnly presented this sheet to the customer.

They paid for the first demonstration launch. Jubilation in the bar. Sea Launch is treating. That's it! The program is complete! Now home. Ten days to land.

In the morning, we inspected the platform. We could launch again right now. Even the paint wasn't scorched. A line was drawn at an angle with chalk on the deck.



Demosat spacecraft insertion scheme

Everyone is satisfied with the accuracy of the insertion.

— Equator, — explains A. A. Shumilin. The rocket stood exactly on the equator. When else will it be possible to stand like that, with one part in the Southern Hemisphere and the other in the Northern?

We took pictures. Interesting!

We begin to understand that a momentous event has occurred.

CNN constantly repeats stories about the launch.

The “Sea Launch” has begun.

Seven feet under your keel, sea cosmodrome!



L. V. Gribachev, V. P. Legostaev, V. G. Aliev, B. Bogdan, V. M. Filin, A. Ashby

LAST CHAPTER

The euphoria of the launch has passed. And involuntarily, you start to analyze: what happened, what did “Sea Launch” provide?

In the times of the Soviet Union, we didn't think about where to find work. It was everywhere. Times have changed, and now our country has become another state where unemployment reigns. Only now have we understood what the global struggle for jobs is, and “Sea Launch” was our small victory. More than ten thousand Russians found work.



Group of RB flight control specialists



Group of measurement complex specialists



After the launch on board the launch platform. V. Aliev, A. Shumilin, V. Legostaev, A. Agarkov, V. Filin



“Harbinger” of luck. Captain T. Hansen and V.M. Filin with a caught shark

All terrestrial spaceports have certain limitations. These include orbital inclinations, exclusion zones for spent stages, and much more. These drawbacks are not inherent in launches from the ocean. There is also the so-called air launch, where a large aircraft flies to the equator, and a space rocket launches from it. But it is clear to everyone that there are limitations on the transported mass, which puts such a launch at a disadvantage.

Many other scientific and technical problems were also solved. But all that is in the past.

New launches are being prepared. Today, everyone is convinced that the launch works. Now it's not our General's fantasy—it's a reality.

It is joyful to realize that our enterprise has again seized leadership in the cosmic direction of human activity, that our enterprise has become one of the well-known and reliable global partners. It worked for the glory of our Motherland during a turbulent time of state reorganizations. The successes of the enterprise are an assessment of the work of its leader, and it is very offensive when, on the eve of the launch, the leaders of our related enterprises speak in the press with words that the “Sea Launch” project is irrational, and after the launch, they give interviews about their invaluable contribution to this project. We observe with surprise that many leaders in our industry were only busy with making the “Sea Launch” project. And precisely those who put

spokes in the wheels. Just imagine for a minute what would have happened in case of failure! How much dirt would have been poured on the General's head and on everyone who worked with him on this topic.

The launch has passed. Now we can expect the awarding of the uninjured. After all, those who made the project will be busy with work, and others will handle the paperwork, and they already know whom to include in the lists. Maybe this time there will be an exception? One wants to believe!

The launch passed. It hit "the bullseye." But the analysis showed that there are remarks. I don't remember a single launch where telemetry didn't find a deviation from the norm of one parameter or another, and the task of the developers is to carefully examine every imperfection, conduct an analysis, and develop measures to eliminate these imperfections. There are no trifles in rocket technology. The cost is very huge. So there is a lot of work ahead.

So I want to wish everyone who worked on the project patience, endurance, and perseverance in their daily work on the project and thank them for their selfless labor.

AFTERWORD

On October 10, 1999, at 6:28 AM (Moscow Time), the second launch of the Zenit rocket took place, carrying the DM-SL Block D-3 upper stage and the Derec TV 1-R spacecraft.

Many people were involved in the project. These included citizens of Russia, Ukraine, Norway, England, and America. In Russia and Ukraine alone, tens of thousands of people worked on this problem. And, of course, after reading this small book, everyone would want to see themselves in this story. Everyone wanted to see an evaluation of their work, and not just an evaluation, but also a description of the events in which they participated. Unfortunately, this is impossible to do. After all, everyone's perception of events is their own. It depends on upbringing, education, mood, and, of course, the person's intellect. Therefore, some events described here may have a completely different interpretation. The author wishes to apologize to those who feel that their role in the project was not fully developed, or that their "heroism" in the simple daily work of creation was not shown. The author did not intend to offend anyone, but rather tried to tell about some of the interpersonal relationships that accompanied the project. The technical side is clearly visible in the created means and results of the project, but social issues remain on the sidelines, as if off-screen. And if what is read evokes warm memories of the difficult, intense days of working on the project among its creators, this will be the author's reward for his small narrative.

And finally. Of course, I want to express my gratitude to all participants in the project, and especially to the one who kept the entire creation process under constant attention and control, and whose active involvement did not allow all project participants to relax during the work, and who, in difficult moments, made fundamental decisions that determined the fate of the project.

In conclusion, the author would like to express his sincere gratitude to his colleagues: S. N. Zakharov, G. S. Kutaev, E. P. Rekova, N. I. Levochkina for editing and formatting the book, as well as Mr. B. Wilson for providing photographic materials on this fantastic complex.